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XXVI.—*A Revision of the Clupeoid Fishes of the Genera Pomolobus, Brevoortia and Dorosoma, and their Allies.*  
By C. TATE REGAN, M.A.

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THE genera dealt with in this revision are the Clupeinæ with a distinct notch in the middle of the upper jaw; these have usually been placed in two distinct groups—those with terminal mouth and the last dorsal ray not prolonged being associated with *Clupea*, and the others, with inferior mouth or last dorsal ray prolonged, forming a group apart (Chatoessinæ of Günther, Dorosomatidæ of modern authors); in my judgment this is quite an artificial arrangement. All these fishes appear either to be migratory, entering rivers to spawn in fresh or brackish water\*, or are permanently fluviatile (e. g., *Gudusia*, *Signalosa*).

### *Synopsis of the Genera.*

- I. Gill-rakers of epibranchial of first arch folding downwards, those near the angle overlapping the gill-rakers of the ceratobranchial.
    - A. Scales with edges entire or feebly serrated; normal scales from occiput to dorsal fin; pelvic fins 9-rayed; operculum with radiating grooves.
- Teeth on vomer and palatines (rarely deciduous in adults)..... 1. *Caspialosa*.

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\* The breeding-habits of *Ethmidium* and *Ethmalosa* are unknown to me.

- Palate toothless; lower jaw not prominent, its tip included ..... 2. *Alosa*.  
 Palate toothless; lower jaw projecting ..... 3. *Pomolobus*.
- B. Scales with edges serrated in young, pectinated in adults; pelvic fins 7-rayed.
- A well-defined series of pectinated scales on each side of middle line from occiput to dorsal fin; operculum striated or nearly smooth .. 4. *Brevoortia*.  
 A median series of scutes from occiput to dorsal fin; operculum smooth or very feebly striated. 5. *Ethmidium*.
- II. Gill-rakers of epibranchial of first arch not folding downwards over those of ceratobranchial; pelvic fins 8-rayed; operculum smooth.
- A. Edge of dentary not reflected outwards in front of maxillary.
1. Last dorsal ray not prolonged.
- Upper gill-rakers of first and second arches and all of succeeding arches bent or expanded, T-shaped or triangular in section ..... 6. *Ethmalosa*.  
 Gill-rakers normal; scales large, 40-50/13-20 .. 7. *Hilsa*.  
 Gill-rakers normal; scales small, 75-100/27-34 . 8. *Gadusia*.
2. Last dorsal ray prolonged into a filament.
- Mouth terminal or subterminal; maxillary normal, with one supramaxillary ..... 9. *Clupanodon*.  
 Mouth terminal; maxillary normal, with two supramaxillaries ..... 10. *Signalosa*.  
 Mouth subterminal or inferior; maxillary slender, with one supramaxillary ..... 11. *Dorosoma*.
- B. Edge of dentary reflected outwards in front of extremity of maxillary; mouth toothless, subterminal or inferior, transverse, its cleft forming an angle; one supramaxillary.
- Maxillary slender, distally slightly expanded and curved downwards; last dorsal ray produced into a filament ..... 12. *Nematalosa*.  
 Maxillary slender, distally slightly expanded and curved downwards; last dorsal ray not produced ..... 13. *Goniatalosa*.  
 Maxillary a straight, thin, transversely expanded lamina, tapering distally; last dorsal ray not produced ..... 14. *Anodontostoma*.

## 1. CASPIALOSA, Berg, 1915.

*Clupeonella* (non Kessler), Berg, Ann. & Mag. Nat. Hist. (8) xi. 1913, p. 472.

*Caspialosa*, Berg, Poiss. de l'eau douce de la Russie, p. 22 (1916).

Differs from *Alosa* in having three patches of teeth on the palate, borne by the vomer and palatine bones; but in large examples of *C. caspia* I find that the palate is toothless.

Black and Caspian Seas.

Berg recognizes thirteen species of this genus.

2. *ALOSA*, Cuv. 1829.

Régne Animal, ed. 2, ii. p. 319; Regan, Ann. & Mag. Nat. Hist. (8) xviii. 1916, p. 6.

North Atlantic and Mediterranean.

In my revision five species and six subspecies were recognized.

3. *POMOLOBUS*, Rafin. 1820.

Fath. Ohionensis, p. 38; Jord. & Everm. Bull. U.S. Nat. Mus. xlvii. 1896, p. 424.

Distinguished from *Alosa* by the prominent lower jaw, with its tip not included.

Western North Atlantic.

*Synopsis of the Species.*

I. Lower jaw strongly projecting; 20 to 25 gill-rakers on lower part of anterior arch.

Anterior teeth persistent; maxillary extending to below posterior part of eye; caudal peduncle longer than deep. . . . . 1. *chrysochloris*.  
Jaws toothless; maxillary extending to below middle of eye; caudal peduncle as long as deep. . . . . 2. *mediocris*.

II. Lower jaw a little projecting; 40 to 50 gill-rakers on lower part of anterior arch.

Depth  $3\frac{1}{2}$ , head  $4\frac{2}{3}$  in the length; eye  $4\frac{1}{2}$  to 5 in head (in specimens of 220-260 mm.) . . . . . 3. *estivalis*.  
Depth 3, head 4 to  $4\frac{1}{2}$  in the length; eye  $3\frac{1}{2}$  to 4 in head (in specimens of 220-260 mm.) . . . . . 4. *pseudoharengus*.

1. *Pomolobus chrysochloris*.

*Pomolobus chrysochloris* (Rafin. 1820), Jord. & Everm. Bull. U.S. Nat. Mus. xlvii. 1893, p. 425, and 1900, fig. 187.

Depth of body  $3\frac{3}{4}$  in the length, length of head 4. Snout longer than diameter of eye, which is 6 in length of head; maxillary extending to below posterior part of eye; lower jaw strongly projecting; small conical teeth persistent in premaxillaries and anterior part of lower jaw; 23 gill-rakers on lower part of anterior arch. 56 scales in a longitudinal series, 17 in a transverse series; ventral scutes 21+15. Dorsal 18. Anal 18. Pelvics a little in advance of middle of dorsal. Caudal peduncle longer than deep. Silvery; back darker.

Mississippi and southern coast of U.S.A.

A single specimen, 280 mm. long, from Pensacola.

2. *Pomolobus mediocris*.

*Pomolobus mediocris* (Mitchill, 1815), Jord. & Everm. Bull. U.S. Nat. Mus. xvii, 1896, p. 425, and 1900, fig. 183.

Depth of body  $3\frac{1}{3}$  to  $3\frac{3}{4}$  in the length, length of head 4 to 4 $\frac{1}{4}$ . Snout longer than diameter of eye, which is 5 in length of head; maxillary extending to below middle of eye or a little beyond; lower jaw strongly projecting; jaws toothless. 21 or 22 gill-rakers on lower part of anterior arch. 56 scales in a longitudinal series, 17 in a transverse series; ventral scutes 21-22+16. Dorsal 16-18. Anal 20-22. Pelvies in advance of middle of dorsal. Caudal peduncle as long as deep. Silvery; back darker; each scale on sides with a dark spot.

Atlantic coast of U.S.A.

Three specimens, 280 to 300 mm. long, from the Potomac and Woods Hole.

3. *Pomolobus estivalis*.

*Pomolobus estivalis* (Mitchill, 1815), Jord. & Everm. Bull. U.S. Nat. Mus. xvii, 1896, p. 426, and 1900, fig. 190.

Depth of body  $3\frac{1}{2}$  in the length, length of head 4 $\frac{2}{3}$ . Snout a little longer than diameter of eye, which is  $4\frac{1}{3}$  to 5 in the length of head; maxillary extending to below anterior part or middle of eye; lower jaw a little projecting; jaws toothless; 44 to 47 gill-rakers on lower part of anterior arch. 52 to 55 scales in a longitudinal series, 15 or 16 in a transverse series; ventral scutes 20+14. Dorsal 17-18. Anal 18-20. Pelvies below anterior half of dorsal. Caudal peduncle longer than deep. Silvery; back darker.

Atlantic coast of U.S.A.

Two specimens, 220 and 260 mm. in total length.

4. *Pomolobus pseudoharengus*.

*Pomolobus pseudoharengus* (Wilson, c. 1811), Jord. & Everm. Bull. U.S. Nat. Mus. xvii, 1896, p. 426, and 1900, fig. 189.

Depth of body 3 in the length, length of head 4 to 4 $\frac{1}{4}$ . Snout as long as or shorter than diameter of eye, which is  $3\frac{1}{2}$  to 4 in the length of head; maxillary extending to below middle of eye or a little beyond; lower jaw a little projecting; jaws toothless; 40 to 42 gill-rakers on lower part of anterior arch. 52 to 56 scales in a longitudinal series, 15 to 17 in a transverse series; ventral scutes 20-21+12-14.

Dorsal 16-18. Anal 18-22. Pelvics below anterior half of dorsal. Caudal peduncle as long as deep, or deeper than long. Silvery; back darker.

Atlantic coast of U.S.A.

Seven specimens, 220 to 260 mm. in total length.

#### 4. BREVOORTIA, Gill, 1861.

Proc. Ac. Philadelphia, p. 37; Jord. & Everm. Bull. U.S. Nat. Mus. xlvii. 1896, p. 433.

This genus is distinguished from *Alosa* by the pectinated scales. The gill-rakers are very numerous, long and slender.

##### 1. *Brevoortia tyrannus*.

*Clupea tyrannus*, Latrobe, Trans. Amer. Phil. Soc. v. 1872, p. 77, pl. i.

*Clupeanodon aureus*, Agassiz, Spix, Pisc. Brasil. p. 52, pl. xxi. (1828).

*Clupea menhaden* (Mitchill, 1815), Günth. Cat. Fish. vii. p. 436 (1878).

*Clupea aurea*, Günth. t. c. p. 437.

*Brevoortia tyrannus*, Goode, Rep. U.S. Fish. Comm. 1877, p. 19, pls. i., ii. (1879); Jord. & Everm. Bull. U.S. Nat. Mus. xlvii. 1896, p. 433.

*Brevoortia patronus*, Goode, t. c. p. 20, pl. v.

Depth of body  $2\frac{1}{2}$  to  $3\frac{1}{2}$  in the length, length of head  $2\frac{1}{2}$  to  $3\frac{1}{2}$ . About 70 gill-rakers (in the adult) on ceratobranchial or first arch. About 50 scales in a longitudinal and 25 in a transverse series; in adults scales very deep, two often meeting across one of the intermediate longitudinal series, thus increasing the number of transverse rows; ventral scutes 18-20 + 11-12. Dorsal 18-21. Anal 19-24. Pelvics below or in advance of anterior rays of dorsal. Vertebrae 48. Nova Scotia to Gulf of Mexico and Brazil.

Several examples up to 350 mm. in total length; one of these, from Alabama, and therefore *B. patronus*, is exactly similar to the specimen 8 inches long, from Woods Hole, figured by Goode. Günther's example named *Clupea aurea* is without locality, and may be North American; the distribution of this species on the coast of South America has yet to be made out.

##### 2. *Brevoortia pectinata*.

*Alosa pectinata*, Jenyns, Zool. 'Beagle,' Fish. p. 135, pl. xxv. (1842).

*Clupea pectinata*, Günth. Cat. Fish. vii. p. 437 (1868).

*Brevoortia pectinata*, Goode, Rep. U.S. Fish. Comm. 1877, p. 30, pl. vi. (1879).

Depth of body  $2\frac{1}{3}$  to  $2\frac{2}{3}$  in the length, length of head 3 to  $3\frac{1}{2}$ . Gill-rakers more numerous than in *B. tyrannus*, about

90 on ceratobranchial of first arch. Scales more regularly arranged and not so deep as in *B. tyrannus*; about 48 in a longitudinal series, 20 to 25 in a transverse series; ventral scutes 18-20 + 10-12. Dorsal 17-19. Anal 18-22. Pelvies below or in advance of origin of dorsal. Vertebrae 44.

Northern Patagonia to Southern Brazil.

Here described from the types, skins, 180 and 260 mm. in length (the larger kindly sent to me for examination by C. Forster Cooper, Esq.), and from four examples of 220 mm. from Rio Grande do Sul.

#### 5. *ETHMIDIUM*, Thompson, 1916.

Proc. U.S. Nat. Mus. l. p. 458.

Closely related to *Brevoortia*, but with a median series of scutes from occiput to dorsal fin.

#### *Ethmidium maculatum*.

*Almusa maculata*, Cuv. & Val. Hist. Nat. Poiss. xx. p. 430 (1847).

*Almusa carulea*, Cuv. & Val. l. c. p. 432.

*Clupea notacanthus*, Günth. Cat. Fish. vii. p. 443 (1868).

*Clupea maculata*, Günth. l. c.

*Clupea (Almusa) notacanthoides*, Steind. Sitzungs-b. Akad. Wien, lx. 1869, p. 309, pl. vii.

*Ethmidium notacanthoides*, Thompson, Proc. U.S. Nat. Mus. l. 1916, p. 458.

*Ethmidium carulea*, Thompson, l. c. p. 460.

Depth of body in the adult equal to length of head, 3 in length of fish; in the young head relatively shorter and body deeper. Diameter of eye 4 to 7 in length of head; maxillary extending to below posterior part of eye or beyond. 80 (young) to 160 (adult) gill-rakers on lower part of anterior arch. 24 to 28 scutes from occiput to dorsal fin; about 50 scales in a longitudinal, 17 to 20 in a transverse series; ventral scutes 18-20 + 15-17. Dorsal 19-22. Anal 14-18. Pelvies below anterior  $\frac{1}{2}$  of dorsal. Vertebrae 50. Silvery; back bluish; sometimes a lateral series of dark spots.

Peru and Chile.

Four specimens, 100-280 mm. long, from Callao, Valparaiso, and Helladura Bay.

#### 6. *ETHMALOSA*, gen. nov.

Form rather deep and strongly compressed. Upper jaw with median notch; lower jaw included; teeth minute or absent. Adipose eyelid well developed; cheek moderately deep, with a naked area below the suborbitals. Operculum

smooth except for a groove parallel to its anterior edge; suboperculum tapering upwards; opercular margin rounded; 6 branchiostegals. Lower gill-rakers of first and second arches long, slender, and numerous, those of ceratobranchial folding over those of epibranchial, which are curiously expanded, T-shaped or triangular in section, appearing angularly bent on the lower side, but not on the upper; gill-rakers of third and fourth arches similarly expanded or recurved, the series fitting closely to form a sieve. About 45 scales in a longitudinal and 16 to 19 in a transverse series; edges of scales crenulated in the young, pectinated in the adult; transverse grooves paired, not meeting in the middle of the scale, only the most posterior groove extending right across; a well-defined mid-dorsal double row of scales, commencing with a large postoccipital pair, extends backwards to the dorsal fin; ventral scutes with sharp-pointed keels. Dorsal fin of 16 to 19 rays; a very low basal sheath. Anal of 20 to 23 rays. Pelvics 8-rayed, inserted below anterior  $\frac{1}{2}$  of dorsal. Caudal with alar scales.

*Ethmalosa dorsalis*.

*Meletta senegalensis*, Cuv. & Val. Hist. Nat. Poiss. xx. p. 370 (1847).

*Alosa dorsalis*, Cuv. & Val. *l. c.* p. 418.

*Alosa platycephalus*, Bleek. Verh. Holl. Maatsch. Haarlem, 1862, Guinée, p. 123, pl. xxvi. fig. 2.

*Copea dorsalis*, Günth. Cat. Fish. vii. p. 438 (1868).

*Clupea setosa*, Steind. Sitzungs. Akad. Wien, lx. 1869, p. 811, pl. vi.

Depth of body  $2\frac{1}{2}$  to 3 in the length, length of head 3 to  $3\frac{2}{3}$ . Diameter of eye  $4\frac{1}{2}$  to 6 in length of head. Maxillary extending to below middle or posterior part of eye. About 45 scales in a longitudinal, 16 to 19 in a transverse series; ventral scutes 16-19+11-13. Dorsal 16-19. Anal 20-23. Pelvics below anterior  $\frac{1}{2}$  of dorsal. Silvery; back darker; tip of dorsal fin blackish.

West Africa.

Numerous examples up to 300 mm. in total length.

7. *HILSA*, gen. nov.

*Paralosa* (non Bleek.), Regan, Ann. Durban Mus. i. 1916, p. 167.

Distinguished from *Alosa* by the smooth operculum and the different arrangement of the gill-rakers of the anterior arch, from *Ethmalosa* by the normal structure of the gill-rakers, and from both by the absence of alar scales on the caudal fin.



Coasts and rivers from Natal to China.

In the young the body is deeper and the head smaller than in the adults, the greater length of the head in the latter being mainly due to the size of the operculum.

*Synopsis of the Species.*

I. Parietal ridges expanded and striated.

- A. Depth  $2\frac{1}{2}$  to 3 in the length.
- |   |                         |
|---|-------------------------|
| Head 3 to $3\frac{1}{2}$ in the length              | 1. <i>kanagurta</i> .   |
| Head $3\frac{1}{2}$ to $3\frac{3}{4}$ in the length | 2. <i>durburensis</i> . |
| B. Depth $2\frac{1}{2}$ in the length               | 3. <i>brachysoma</i> .  |

II. Parietal ridges narrow, covered by smooth skin.

- A. Maxillary extending to below middle of eye (young) or beyond.
- |   |                     |
|---|---------------------|
| 1. Caudal lobes as long as head.  |                     |
| Operculum $\frac{1}{2}$ to $\frac{3}{4}$ as broad as deep; scales 45-48, 17-20.               | 4. <i>ilisha</i> .  |
| Operculum $\frac{1}{2}$ to $\frac{3}{4}$ as broad as deep; scales 42-45, 16-17.               | 5. <i>reevesi</i> . |
| 2. Caudal lobes longer than head.   |                     |
| Operculum $\frac{1}{2}$ to $\frac{3}{4}$ as broad as deep; scales 40, 14-15                   | 6. <i>tofi</i> .    |
| B. Maxillary not reaching middle of eye; caudal lobes much longer than head; scales 45, 14-15 | 7. <i>macrura</i> . |

1. *Ilisa kanagurta*.

*Alosa kanagurta*, Bleek. Verh. Bat. Gen. xxiv. 1852, Haringoet, p. 34; Atl. Ichth. vi. p. 114, Clup. pl. vii. fig. 5 (1872).

*Alosa malayana*, Bleek. Ned. Tijdschr. Dierk. iii. 1866, p. 294; Atl. Ichth. vi. p. 114, Clup. pl. vii. fig. 4.

*Clupea ilisha*, Günth. Cat. Fish. vii. p. 445 (1868).

*Clupea kanagurta*, Day, Fish. India, p. 649, pl. clxii. fig. 4; Weber & Beaufort, Fish. Indo-Austral. Arch. ii. p. 67 (1913).

Depth of body  $2\frac{1}{2}$  to 3 in the length, length of head 3 to  $3\frac{1}{2}$ . Parietal ridges expanded and striated. Snout nearly as long as or a little longer than diameter of eye, which is  $3\frac{1}{2}$  to  $4\frac{1}{2}$  in length of head; maxillary extending to below middle or posterior part of eye; width of operculum  $\frac{1}{2}$  or less than  $\frac{1}{2}$  its depth; 100 to 150 gill-rakers on lower part of anterior arch. 42 to 45 scales in a longitudinal series, 13 or 14 in a transverse series; ventral scutes 16-18+11-13. Dorsal 17-20. Anal 19-22. Pelvics below anterior half of dorsal. Caudal about as long as head. A dark humeral spot, in the young followed by a series.

Zanzibar to Malay Archipelago.

Fifteen examples, up to 220 mm. in total length.

## 2. *Hilsa durbanensis*.

*Clupea durbanensis*, Regan, Ann. Natal Govt. Mus. i. 1906, p. 4, pl. iv.; Gilchrist, S. Afr. Mar. Biol. Rep. i. 1913, p. 59.

Depth of body  $2\frac{1}{2}$  to 3 in the length, length of head  $3\frac{3}{4}$  to  $3\frac{1}{2}$ . Parietal ridges expanded and striated. Snout as long as or slightly longer than diameter of eye, which is 4 to  $1\frac{1}{2}$  in length of head; maxillary extending to below middle or posterior part of eye; width of operculum  $\frac{2}{5}$  its depth; 150 gill-rakers on lower part of anterior arch. 42 to 44 scales in a longitudinal, 13 or 14 in a transverse series; ventral scutes 16-17+12-13. Dorsal 17-18. Anal 19-21. Pelvics below anterior half of dorsal. Caudal fin about as long as head. A dark humeral spot. Upper edge of dorsal and posterior edge of caudal blackish.

Natal.

Three specimens from Durban, 140 to 200 mm. in total length.

Gilchrist has examined a large example, 240 mm. long to base of caudal fin; in this the head is  $3\frac{3}{4}$  in the length, and there are 200 gill-rakers on the lower part of the anterior arch.

## 3. *Hilsa brachysoma*.

*Hilsa brevis*, Bleek. J. Ind. Arch. ii. no. 9, 1848, p. 638; Atl. Ichth. vi. p. 116 (1872).

*Awa brachysoma*, Bleek. Nat. Tijdschr. Ned. Ind. v. 1853, p. 527; Atl. Ichth. vi. p. 115, Clap. pl. iv. fig. 5 (1872).

*Clupea platygaster*, Günth. Cat. Fisk. vii. p. 448 (1868); Weber & Beaufort, Fish. Indo-Austral. Arch. ii. p. 66, fig. 24 (1913).

Depth of body  $2\frac{1}{4}$  in the length, length of head  $3\frac{3}{4}$ . Parietal ridges expanded and striated. Snout as long as diameter of eye, which is 4 in length of head; maxillary extending beyond middle of eye; width of operculum  $\frac{2}{5}$  its depth; 100 gill-rakers on lower part of anterior arch. 42 scales in a longitudinal, 15 in a transverse series; ventral scutes 17+12. Dorsal 17-18. Anal 20-21. Pelvics below middle of dorsal. Caudal about as long as head. A dark humeral spot; dorsal and caudal dark-edged.

Sumatra.

Here described from Bleeker's type and only specimen, which has the head and body deeper and the lower jaw longer etc. than in *A. kanagurta* of this size (120 mm.); also the first mid-dorsal post-cephalic scale is a striated bony plate.

Weber and Beaufort's figure is of a fish that agrees with Bleeker's in the appearance of the head, but is more elongate in form, the depth about  $2\frac{2}{3}$  in the length.

4. *Hilsa ilisha*.

*Cupanodon ilisha*, Ham. Buch. Fish. Ganges, p. 243, pl. xix. fig. 75.

*Alosa palasah*, Cuv. & Val. Hist. Nat. Poiss. xx. p. 432 (1847).

*Clupea palasah*, Günth. Cat. Fish. vii. p. 415 (1868).

*Clupea ilisha*, Day, Fish. India, p. 640, pl. clxxii. fig. 3 (1878).

Depth of body  $2\frac{1}{2}$  to 3 in the length, length of head  $3\frac{1}{4}$  to  $3\frac{3}{4}$ . Parietal ridges narrow, covered with smooth skin in the adult fish. Snout as long as or longer than diameter of eye, which is  $4\frac{2}{3}$  to 7 in the length of head; maxillary extending to below posterior part of eye or beyond; width of operculum from a little more than  $\frac{1}{2}$  to  $\frac{2}{3}$  of its depth; 120 (young) to 220 gill-rakers on lower part of anterior arch. 45 to 48 scales in a longitudinal and 17 to 20 in a transverse series; ventral scutes 17-19+13-14. Dorsal 18-20. Anal 18-21. Pelvic fins below anterior part of dorsal. Caudal fin about as long as the head. Vertebrae 47.

Persian Gulf to Burma.

Several specimens, 130 to 350 mm. in total length.

5. *Hilsa reevesii*.

*Alosa reevesii*, Richards, Ichth. China, p. 305 (1846).

*Alosa palasah*, Richards, *l. c.* p. 306.

*Clupea reevesii*, Günth. Cat. Fish. vii. p. 446 (1868).

Depth of body 3 to  $3\frac{1}{2}$  in the length, length of head 3 to  $3\frac{1}{2}$ . Upper surface of head covered with skin; no striated bones exposed, except in the young. Snout longer than diameter of eye, which is 5 to 9 in length of head; maxillary extending to below posterior part or edge of eye, or a little beyond; width of operculum  $\frac{2}{3}$  or more than  $\frac{2}{3}$  of its depth; gill-rakers long and slender. 150 (young) to 250 on lower part of anterior arch. 42 to 45 scales in a longitudinal, 16 or 17 in a transverse series; ventral scutes 18+13-14. Dorsal 17-18. Anal 18-19. Pelvics below anterior half of dorsal. Caudal fin about as long as the head.

China.

Seven examples, 150 to 500 mm. long, from Shanghai and Kiu Kiang.

6. *Hilsa toli*.

*Alosa toli*, Cuv. & Val. Hist. Nat. Poiss. xx. p. 435 (1847); Bleek.

Atl. Ichth. vi. p. 113, Clup. pl. viii. fig. 4 (1872).

*Alosa ctenolepis*, Bleek. Verh. Bat. Gen. xxiv. 1852, Haringacht. p. 32.

*Clupea toli*, Günth. Cat. Fish. vii. p. 447 (1868); Day, Fish. India,

p. 641, pl. clxii. fig. 2 (1878); Weber & Beaufort, Fish. Indo-

Austral. Arch. ii. p. 64 (1913).

*Clupea chapra*, Günth. *l. c.*

Depth of body  $2\frac{2}{3}$  to  $3\frac{1}{4}$  in the length, length of head  $3\frac{1}{2}$  to 4. Parietal ridges narrow, covered with smooth skin in the adult fish. Snout as long as or longer than diameter of eye, which is  $4\frac{1}{3}$  to  $7\frac{1}{2}$  in the length of head; maxillary extending to below posterior part of eye or beyond; width of operculum from  $\frac{1}{2}$  to nearly  $\frac{2}{3}$  of its depth; 70 to 95 gill-rakers on lower part of anterior arch. About 40 scales in a longitudinal and 11 or 15 in a transverse series; ventral scutes 17-18 + 11-13. Dorsal 17-19. Anal 18-21. Pelvics below middle of dorsal. Caudal lobes, in the adult fish, nearly  $1\frac{1}{2}$  as long as head.

India, Malay Peninsula and Archipelago.

Several examples, 120 to 450 mm. in total length.

#### 7. *Hilsa macrura*.

*Alosa macrurus*, Bleek. Verh. Bat. Gen. xxiv. 1852. Haringacht. p. 31; Atl. Ichth. vi. p. 113, Clapp. pl. vi. fig. 4 (1872).

*Clupea macrura*, Günth. Cat. Fish. vii. p. 448 (1868); Weber & Beaufort, Fish. Indo-Austral. Arch. ii. p. 65 (1913).

Depth of body  $2\frac{2}{3}$  to  $3\frac{1}{4}$  in the length, length of head 4 to  $4\frac{1}{2}$ . Parietal ridges narrow, covered with smooth skin in the adult fish. Snout not longer than diameter of eye, which is 4 to 5 in the length of head; maxillary extending to below anterior  $\frac{1}{3}$  of eye; width of operculum  $\frac{1}{2}$  its depth; 60 to 80 gill-rakers on lower part of anterior arch. About 45 scales in a longitudinal and 14 or 15 in a transverse series; ventral scutes 16-18 + 11-15. Dorsal 17-20. Anal 18-21. Pelvics below middle or anterior part of dorsal. Caudal lobes, in the adult fish, nearly twice as long as head.

Sunda Islands.

Three examples, 160 to 350 mm. in total length.

#### 8. *GUDUSIA*, Fowler, 1911.

Proc. Acad. Philadelphia, lxiii. p. 207.

Distinguished from *Hilsa* by the smaller scales.

Two species from the rivers of India and Burma.

##### 1. *Gudusia chapra*.

*Clupanodon chapra*, Ham. Buch. Fish. Ganges, p. 248.

*Clupea indica*, Gray, Ill. Ind. Zool.; Günth. Cat. Fish. vii. p. 444 (1868).

*Alosa microlepis*, Cuv. & Val. Hist. Nat. Poiss. xx. p. 439 (1847).

*Clupea chapra*, Day, Fish. India, p. 639, pl. cli. fig. 1 (1878).

*Clupea sushia*, Chaudhuri, Rec. Ind. Mus. vii. 1912, p. 439, pl. xxxviii fig. 1.

Depth of body  $2\frac{2}{3}$  to  $3\frac{1}{2}$  in the length, length of head  $3\frac{1}{2}$  to  $3\frac{3}{4}$ . Snout shorter than diameter of eye, which is 4 in length

of head; maxillary extending to below anterior part of middle of eye; 200 or more gill-rakers on lower part of anterior arch. 75 to 100 scales in a longitudinal and 27 to 34 in a transverse series; ventral scutes 18-20+8-10. Dorsal 14-16. Anal 20-24. Pectoral 13-14. Pelvics nearly below origin of dorsal. Usually a dark humeral spot, sometimes followed by a series.

Northern India, from Sind to Assam.

Several examples, 120 to 140 mm. long.

## 2. *Gadusia variegata*.

*Clupea variegata*, Day, Proc. Zool. Soc. 1869, p. 263; Fish. India, p. 639, pl. clxi. fig. 4.

Depth of body  $2\frac{1}{2}$  in the length, length of head  $3\frac{1}{4}$ . Snout a little shorter than diameter of eye, which is  $4\frac{1}{4}$  in length of head; maxillary extending to below middle of eye; more than 200 gill-rakers on lower part of anterior arch. 90 scales in a longitudinal and 32 in a transverse series; ventral scutes 19+10. Dorsal 16. Anal 23. Pectoral 14. Pelvics nearly below origin of dorsal. Back with several vertically expanded dark spots.

Burma.

A single specimen, 166 mm. in total length.

According to Day, this species differs from *G. chapra* in the deeper body, the coloration, and 24 to 29 instead of 21 to 24 anal rays.

## 9. CLUPANODON, Lacep. 1803\*.

Hist. Nat. Poiss. v. p. 468; Bleek. Atl. Ichth. vi. p. 112 (1872).

*Konosirus*, Jord. & Snyder, Proc. U.S. Nat. Mus. xxiii. 1900, p. 349.

Mouth toothless, terminal or subterminal, with lateral

\* Of the six species placed by Lacepède in *Clupanodon*, Jordan (in collaboration) has at different times regarded as the genotype: 1. *jussieu* (by designation), 2. *pulchardus* (by elimination), and 3. *thrissa* (the first species). But before this, in 1872, Bleeker (Atl. Ichth. vi. p. 112) stated that *Clupanodon thrissa* was the type of Lacepède's genus. Reference to Lacepède's work leaves no doubt that his species was the true *Clupea thrissa* of Linneus, who took the name and the diagnosis respectively from Osbeck and from Langerström. Lacepède took the specific name from Linneus, and gave China as the first locality; his description of the pointed lower jaw and the notched upper jaw, and his statement that the fish spawns in fresh water, apply quite well to the Chinese species, but not to the Antillean species (*Opisthonema oglinum*), which so many of the older writers believed to be the same fish. Consequently I regard the *Clupea thrissa* of Osbeck, Linneus, and Lacepède, and not the *Clupea thrissa* of Bleek and of Günther, as the type of *Clupanodon*.

left; maxillary normally formed, extending to below anterior part or middle of eye; anterior supramaxillary absent. Gill-rakers slender, very numerous. Dorsal 15-18; last ray produced into a filament. Anal 20-28. Pelvics 8-rayed, below anterior part of dorsal. 48 to 58 scales in a longitudinal series, 20-23 in a transverse series. Vertebrae 51 (in *C. punctatus*).

Coasts and rivers of China and Japan.

### 1. *Clupanodon thrissa*.

*Copea thrissa*, Osbeck, Iter Chinensis, p. 257 (1757); Linn. Syst. Nat. ed. 10, p. 318 (1758).

*Clupanodon thrissa*, Lacép. Hist. Nat. Poiss. v. p. 468 (1803).

*Chaetossus maculatus*, Richards, Ichth. China, p. 303 (1846); Günth. Cat. Fish. vii. p. 409 (1868).

*Chaetossus osbecki*, Cuv. & Val. Hist. Nat. Poiss. xxi. p. 100 (1848).

Depth of body  $2\frac{2}{3}$  to 3 in the length, length of head  $3\frac{1}{2}$ . Diameter of eye  $4\frac{1}{2}$  to 5 in length of head. Mouth terminal; maxillary extending to below anterior part or middle of eye. 48 scales in a longitudinal, 20 in a transverse series; ventral scutes 18-20+10-12. Dorsal 15-16. Anal 22-27. Pelvics below anterior  $\frac{1}{3}$  of dorsal. A dark humeral spot, sometimes followed by a series of spots.

China; Formosa.

Three specimens of 150-200 mm. from Formosa; two from China, 60 and 90 mm., are not included except for counts of fin-rays etc.

### 2. *Clupanodon punctatus*.

*Chaetossus punctatus*, Schlegel, Faun. Japon., Poiss. p. 240, pl. cix. fig. 1 (1846); Cuv. & Val. Hist. Nat. Poiss. xxi. p. 107 (1848);

Günth. Cat. Fish. vii. p. 408 (1868).

*Chaetossus agnosus*, Richards, Ichth. China, p. 307 (1846); Cuv. & Val. Hist. Nat. Poiss. xxi. p. 109 (1848).

*Konosirus punctatus*, Jord. & Herre, Proc. U.S. Nat. Mus. xxxi. 1906, p. 624.

Depth of body 3 to  $3\frac{1}{2}$  in the length, length of head  $3\frac{2}{3}$  to  $4\frac{1}{2}$ . Diameter of eye  $4\frac{1}{2}$  to 5 in length of head. Mouth subterminal; maxillary extending to below anterior part or nearly to middle of eye. 53 to 58 scales in a longitudinal, 20 to 23 in a transverse series; ventral scutes 18-21+14-17. Dorsal 16-18. Anal 20-25. Pelvics below anterior  $\frac{1}{3}$  of dorsal. A dark humeral spot; a dark spot on each scale of upper half of body. Vertebrae 51.

China; Japan.

Eleven specimens, 150-200 mm. in total length.

10. *SIGNALOSA*, Everm. & Kendall, 1898.

Ball. U.S. Fish. Comm. 1897, p. 127.

Mouth toothless, terminal, with lateral cleft; maxillary normally formed, extending to below anterior edge of eye or a little beyond; two supramaxillaries. Gill-rakers slender, very numerous. Dorsal 13-16; last ray produced into a filament. Anal 21-27. Pelvies 8-rayed, below or a little in advance of origin of dorsal. About 40 scales in a longitudinal series. Vertebrae 41.

Rivers from Southern U.S.A. to Central America.

1. *Signalosa mexicana*.

*Chatoessus mexicanus*, Günth. Cat. Fish. vii. p. 409 (1868).

*Dorosoma mexicanum*, Jord. & Everm. Bull. U.S. Nat. Mus. xlvii. 1896, p. 416.

*Signalosa atchafalaya*, Jord. & Everm. t. c. 1898, p. 2809, fig. 184.

*Signalosa mexicana*, Meek, Zool. Publ. Columbian Mus. v. 1901, p. 91.

Depth of body  $2\frac{3}{4}$  to 3 in the length, length of head 3 to  $3\frac{1}{2}$ . Diameter of eye  $3\frac{1}{2}$  to 4 in length of head; maxillary extending to below anterior edge or  $\frac{1}{4}$  of eye. 200 gill-rakers on lower part of anterior arch. About 40 scales in a longitudinal series; ventral scutes 16-18 + 8-10. Dorsal 13-15; origin equidistant from end of snout and base of caudal, or nearer former. Anal 23-27. Pelvies inserted a little in advance of origin of dorsal. A dark humeral spot.

Louisiana to Central America, in rivers emptying into the Gulf of Mexico.

Nine specimens, 70 to 100 mm. in total length.

2. *Signalosa petenensis*.

*Meletta petenensis*, Günth. Proc. Zool. Soc. 1866, p. 603.

*Chatoessus petenensis*, Günth. Cat. Fish. vii. p. 408 (1868).

Depth of body 3 in the length, length of head  $3\frac{1}{2}$  to 3 $\frac{3}{4}$ . Diameter of eye  $3\frac{1}{2}$  to 4 in length of head; maxillary extending to below anterior  $\frac{1}{4}$  or edge of eye. 160 gill-rakers on lower part of anterior arch. About 40 scales in a longitudinal series; ventral scutes 11-16 + 10-12. Dorsal 15-16; origin nearer to end of snout than to base of caudal. Anal 21-24. Pelvies inserted below origin of dorsal. A dark humeral spot.

Lake Peten.

Four specimens, 70 to 90 mm. in total length.

# 11. *Dorosoma*, Rafin. 1820.

Leith. *Ohiensis*, p. 39.

*Chatoessus* (part.), Cuv. *Règne Anim.* ed. 2, ii. p. 320 (1829); Günth. *Cat. Fish.* vii. p. 406 (1868).

*Chatoessus*, Cuv. & Val. *Hist. Nat. Poiss.* xxi. p. 94 (1848).

Mouth subterminal or inferior; maxillary narrowed distally; anterior supramaxillary absent. Gill-rakers slender, very numerous. Dorsal 12-15; last ray produced into a filament. Anal 26-38. Pelvics 8-rayed, in advance of dorsal. 55 to 80 scales in a longitudinal series. Vertebrae 50.

Atlantic coast and rivers of North and Central America.

## 1. *Dorosoma cepedianum*.

*Megalops cepedianus*, Le Sueur, *Journ. Acad. Philadelphia*, i. 1818, p. 361.

*Catwa heterura*, Rafinesque, *Amer. Monthly Mag.* 1818, p. 354.

*Dorosoma notata*, Rafinesque, *Leith. Ohiensis*, p. 39 (1820).

*Chatoessus ellipticus*, Kirtland, *Rep. Zool. Ohio*, p. 169 (1839).

*Dorosoma inaequalis*, Abbott, *Proc. Acad. Philadelphia*, 1860, p. 365.

*Chatoessus cepedianus*, Günth. *Cat. Fish.* vii. p. 409 (1868).

*Dorosoma cepedianum*, Jord. & Everm. *Bull. U.S. Nat. Mus.* xlvii. 1896, p. 416, and 1900, fig. 183.

*Dorosoma cepedianum exile*, Jord. & Everm. *l. c.*

*Dorosoma exile*, Meek, *Zool. Publ. Columbian Mus.* v. 1904, p. 94.

Mouth small, subterminal or inferior; maxillary extending to below anterior edge of eye. Depth of body 2 to 3 in the length, length of head  $3\frac{3}{4}$  to  $4\frac{1}{2}$ . Diameter of eye 4 to 5 in length of head. 55 to 65 scales in a longitudinal series, 21 to 29 in a transverse series; ventral scutes 17-19 + 10-13. Dorsal 13-15. Anal 30-34. Pelvics inserted in advance of origin of dorsal. A dark humeral spot, most prominent in the young.

Cape Cod to Mexico, entering rivers.

Here described from five specimens, 180 to 260 mm. long, from Virginia, Illinois, and Texas. In these the body is deeper (depth 2 to  $2\frac{1}{2}$  in the length) in the examples from Virginia than in those from Illinois and Texas (depth  $2\frac{2}{3}$  to 3 in the length); but in young specimens this difference is not apparent, the depth being about  $\frac{2}{3}$  of the length in both forms.

## 2. *Dorosoma anale*.

*Dorosoma anale*, Meek, *Zool. Publ. Columbian Mus.* v. 1904, p. 93, fig.

Depth of body  $2\frac{2}{3}$  to 3 in the length. About 70 scales in



a longitudinal series. Dorsal 13-14. Anal 35-38. In other respects like *D. cepedianum*.

Atlantic coast streams of Mexico south of Vera Cruz.

Two examples, 120 to 160 mm. long, from Perez (*Meek*).

### 3. *Dorosoma chavesi*.

*Dorosoma chavesi*, Meek, Zool. Publ. Columbian Mus. vii. 1907, p. 112.

Mouth rather large, with the jaws nearly equal anteriorly, the mandible nearly  $\frac{1}{2}$  the length of head and the slender maxillary extending to below the middle of the eye. Depth of body  $2\frac{1}{2}$  in the length, length of head  $2\frac{3}{4}$  to 3. Diameter of eye 3 to  $3\frac{1}{2}$  in length of head. 74 to 78 scales in a longitudinal series; ventral scutes 17-19+9-10. Dorsal 12-15. Anal 26-30. A dark humeral spot.

Total length 47 to 210 mm.

Lakes Managua and Nicaragua.

## 12. NEMATALOSA, gen. nov.

Mouth toothless, subterminal or inferior, transverse, its cleft forming an angle; maxillary slender, distally slightly expanded and curved downwards; edge of dentary reflected outwards in front of extremity of maxillary; one supra-maxillary. Gill-rakers slender, very numerous. Dorsal 13-18; last ray prolonged into a filament; a scaly sheath at base. Anal 18-24. Pelvics 8-rayed, below or a little in advance of dorsal. Scales 44-50 in a longitudinal series, 14-21 in a transverse series. Vertebrae 43 (in *N. erebi*).

Coasts and rivers of Asia and Australia from Arabia to Japan and New South Wales.

### *Synopsis of the Species.*

- I. Second suborbital covering cheek, its anterior edge vertical and its lower edge horizontal and in contact with lower limb of preoperculum ..... 1. *nasos*.
- II. Second suborbital with oblique antero-inferior edge; a naked area above lower limb of preoperculum.
  - A. Dorsal 16-18; pelvics below anterior part or middle of dorsal.
 

Anal 21-23; depth 3 in length .....	2. <i>japonica</i> .
Anal 19; depth $2\frac{1}{2}$ in length .....	3. <i>arabica</i> .
Anal 20-22; depth 2 to $2\frac{1}{2}$ in length .....	4. <i>come</i> .
  - B. Dorsal rays 13-15. Anal 18-22.
 

Depth 2 to $2\frac{1}{2}$ in length; eye $3\frac{1}{2}$ (young) to 5 (very large fish) in length of head; pelvics below or immediately in advance of origin of dorsal .....	5. <i>erebi</i> .
Depth $2\frac{1}{2}$ to $2\frac{3}{4}$ in length; eye 4 (young) to 5 (adult) in length of head; pelvics below anterior $\frac{1}{2}$ of dorsal ..	6. <i>horni</i> .

1. *Nematalosa nasus*.

*C. nasus* Bloch, *Anst. Fische*, ix, p. 116, pl. ccccxxiv, fig. 1 (1795).  
*C. nasus altus*, Gray, *Ill. Ind. Zool.* pl. xci, fig. 2 (1835).  
*C. nasus nasus*, Cuv. & Val. *Hist. Nat. Pêches*, xxi, p. 101 (1818);  
*Proc. Fish. India*, p. 634, pl. clv, fig. 4 (1878).  
*C. nasus chagpole*, Günth. *Cat. Fish.* vii, p. 410 (1858).

Depth of body  $2\frac{3}{4}$  to  $2\frac{1}{2}$  in the length, length of head  $3\frac{3}{4}$  to 4. Snout as long as or shorter than diameter of eye, which is  $3\frac{3}{4}$  to 4 in length of head; maxillary extending to below anterior  $\frac{1}{4}$  of eye; second suborbital covering cheek, with vertical anterior edge and horizontal inferior edge attached to lower limb of præoperculum. 45 to 50 scales in a longitudinal series, 15 to 19 in a transverse series; ventral scutes 16-19+10-12. Dorsal 15-17. Anal 21-24. Pelvics below origin or anterior  $\frac{1}{3}$  of dorsal. Dark longitudinal streaks along upper series of scales; often a dark humeral spot.

India.

Several examples, 100 to 200 mm. long, from Sind, Bombay, Canara, Madras, Calicut, and Burma.

2. *Nematalosa japonica*, sp. n.

Depth of body 3 in the length, length of head  $1\frac{1}{2}$ . Snout as long as diameter of eye, which is  $4\frac{1}{2}$  in length of head; maxillary extending to below anterior  $\frac{1}{4}$  of eye; second suborbital with oblique lower edge. 48 to 50 scales in a longitudinal series, 19 or 20 in a transverse series; ventral scutes 18-20+12-14. Dorsal 16-18. Anal 21-23. Pelvics below middle or anterior part of dorsal. A dark humeral spot.

Inland Sea of Japan.

Three specimens, 200 mm. in total length.

3. *Nematalosa arabica*, sp. n.

Depth of body  $2\frac{3}{4}$  in the length, length of head  $3\frac{3}{4}$ . Snout as long as diameter of eye, which is  $4\frac{1}{2}$  in length of head; maxillary extending to below anterior  $\frac{1}{4}$  of eye; second suborbital with oblique lower edge. 50 scales in a longitudinal series, 19 in a transverse series; ventral scutes 18+13. Dorsal 17. Anal 19. Pelvics a little in advance of middle of dorsal. Dark longitudinal streaks along series of scales on upper part of body.

Mascat.

A single specimen, 150 mm. in total length.

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4. *Nematalosa come*.

*Chatoessus come*, Richards, 'Erebus' and 'Terror' Fish. p. 62, pl. xxxviii, figs. 7-10 (1846).

*Chatoessus nasus*, Günth. Cat. Fish. vii. p. 407 (1858).

*Dorosoma nasus*, Bleek. Atl. Ichth. vi. p. 142, Clap. pl. ii. fig. 4 (1872); Weber & Beaufort, Fish. Indo-Austral. Arch. ii. p. 24 (1913).

Depth of body 2 to  $2\frac{1}{2}$  in the length, length of head  $3\frac{1}{2}$  to 4. Snout nearly as long as or shorter than diameter of eye, which is 3 to 4 in the length of head; maxillary extending to below anterior  $\frac{1}{3}$  of eye; lower edge of second suborbital oblique. 46 to 50 scales in a longitudinal series, 17 to 20 in a transverse series; ventral scutes 18-20+10-12. Dorsal 16-18. Anal 20-22. Pelvics below anterior part or middle of dorsal. Dark longitudinal streaks along upper series of scales; a blackish humeral spot.

Indo-Australian Archipelago.

Several examples up to 200 mm. in total length, including one that I believe to be the type of the species (*C. nasus*, specimen k of Günther).

5. *Nematalosa erebi*.

*Chatoessus erebi*, Günth. Cat. Fish. vii. p. 407 (1858).

Depth of body 2 to  $2\frac{1}{2}$  in the length, length of head  $3\frac{1}{2}$  to  $4\frac{1}{2}$ . Snout as long as or shorter than diameter of eye, which is  $3\frac{1}{2}$  to 5 in length of head; maxillary extending to below anterior  $\frac{1}{3}$  of eye; second suborbital with oblique lower edge. 46 to 50 scales in a longitudinal series, 17 to 21 in a transverse series; ventral scutes 18-19+10-12. Dorsal 13-16; origin above or immediately behind base of pelvics. Anal 18-22.

East coast of Australia.

Several examples, 100 to 350 mm. in total length, from Cape York, Burnett R., Mary R., and New South Wales.

6. *Nematalosa horni*.

*Chatoessus horni*, Zietz, Rep. Horn. Exped. ii. p. 180, pl. xvi. fig. 6 (1896).

Depth of body  $2\frac{1}{3}$  to  $2\frac{4}{5}$  in the length, length of head  $3\frac{1}{2}$  to 4. Snout as long as or shorter than diameter of eye, which is 4 to 5 in the length of head; maxillary extending to below anterior  $\frac{1}{4}$  of eye; lower edge of second suborbital oblique. 44 to 46 scales in a longitudinal series, 15 to 18 in a transverse series; ventral scutes 16-18+9-11. Dorsal 13-16. Anal 18-22. Pelvics below anterior  $\frac{1}{2}$  of dorsal.

Australia.

Five of the types, 100-170 mm. long, from Red Bank Creek, McDonnell Range; numerous examples from the Bulbo Creek, interior of Queensland ('Challenger') and some from the Borwan R., interior of New South Wales (Stead).

### 13. *GONIALOSA*, gen. nov.

Mouth formed as in *Nematalosa*. Dorsal 14-17; a scaly sheath at base; last ray not prolonged. Anal 22-28. Pelvics 8-rayed, below or in advance of origin of dorsal. Scales 45-75 in a longitudinal series, 16-25 in a transverse series. Vertebrae 44-46.

Rivers of India and Burma.

#### 1. *Gonialosa modesta*.

*Chatoessus modestus*, Day, Proc. Zool. Soc. 1830, p. 622, and Fish. India, p. 633, pl. clx. fig. 1 (1878).

Depth of body 2 to  $2\frac{1}{2}$  in the length, length of head  $3\frac{1}{2}$  to 4. Snout shorter than diameter of eye, which is 3 to  $3\frac{1}{2}$  in the length of head; maxillary extending to below anterior edge of eye. 45 to 47 scales in a longitudinal series, 16 to 18 in a transverse series; ventral scutes 17-19+9-12. Dorsal 14-17. Anal 24-28. Pelvics below or in advance of origin of dorsal. Vertebrae 44. Usually a dark humeral spot.

Burma.

Seven specimens up to 100 mm. in total length.

#### 2. *Gonialosa manmima*.

*Chupānodon manmima*, Ham. Buch. Fish. Ganges, p. 247 (1822).

? *Chupānodon cortius*, Ham. Buch. l. c. p. 249.

*Chatoessus manmima*, Cuv. & Val. Hist. Nat. Poiss. xxi. p. 114 (1843);

Day, Fish. India, p. 633, pl. clx. fig. 2 (1878).

*Chatoessus cortius*, Günth. Cat. Fish. vii. p. 410 (1868).

Depth of body  $2\frac{2}{3}$  to  $3\frac{1}{2}$  in the length, length of head  $3\frac{3}{4}$  to  $4\frac{1}{2}$ . Snout shorter than diameter of eye, which is 3 to  $3\frac{1}{2}$  in length of head; maxillary not or barely reaching eye. 55 to 65 scales in a longitudinal series, 21 to 25 in a transverse series. Ventral scutes 16-19+10-13. Dorsal 14-17. Anal 22-26. Pelvics below or in advance of dorsal. Vertebrae 46. Sometimes a dark humeral spot.

Northern India and Assam.

Several specimens, to 130 mm. in length.

14. *ANODONTOSTOMA*, Bleek. 1849.

Verh. Batav. Genootsch. xxii., Madura, p. 15.

Differs from *Goniistius* in that the maxillary is a straight, thin, transversely expanded lamina, tapering distally, whilst the supramaxillary is very slender. Dorsal 17-19, with a well-developed scaly sheath extending to tip of last ray. Anal 18-21, depressible in a scaly sheath. Pelvics 8-ravel, below middle or anterior half of dorsal. Scales 49-52 in a longitudinal series, 12-17 in a transverse series. Vertebrae 42.

Coasts and rivers of India and Indo-Australian Archipelago.

1. *Anodontostoma chacunda*.*Clupronodon chacunda*, Ham. Bach. Fish. Ganges, p. 246 (1822).*Chatoosus chacunda*, Cuv. & Val. Hist. Nat. Poiss. xxi. p. 111 (1818);

Günth. Cat. Fish. vii. p. 411 (1858); Day, Fish. India, p. 632, pl. clx. fig. 3 (1878).

*Anodontostoma hasseltii*, Bleek. Verh. Batav. Genootsch. xxii. 1849, Madura, p. 15.*Chatoosus selingkat*, Bleek. Verh. Batav. Genootsch. xxiv. 1852, Haringacht, p. 47.*Dorosoma chacunda*, Bleek. Atl. Ichth. vi. p. 113, Clup. pl. iii. figs. 5, 6 (1872); Weber & Beaufort, Fish. Indo-Austral. Arch. ii. p. 25, fig. 14 (1913).

Depth of body 2 to 2½ in the length, length of head 3¼ to 4. Snout shorter than diameter of eye, which is 3 to 3½ in the length of head; maxillary extending to below anterior ½ of eye. 40 to 42 scales in a longitudinal series, 12 to 15 in a transverse series; ventral scutes 16-18 + 10-11. Dorsal 17-19. Anal 18-21. Pelvics below middle or anterior part of dorsal. Dark longitudinal streaks along upper series of scales; a dark humeral spot.

India and Indo-Australian Archipelago.

Numerous examples, up to 160 mm. in total length.

2. *Anodontostoma breviceps*.*Chatoosus breviceps*, Peters, Monatsb. Akad. Berlin, 1876, p. 848.

Depth of body 2½ in the length, length of head nearly 4. Snout ½ as long as eye; maxillary extending to below middle of eye. 42 scales in a longitudinal series, 17 in a transverse series. Dorsal 19. Anal 19. Pelvics below middle of dorsal. Longitudinal dark stripes along upper series of scales.

Total length 230 mm.

New Hanover.

XXVII.—Notes on Fossorial Hymenoptera.—XXVII. On new Species in the British Museum. By ROWLAND E. TURNER, F.Z.S., F.E.S.

Family Scoliidæ.

Subfamily ELDIXÆ.

*Elis bodkini*, sp. n.

♀. Nigra; clypeo lateribus, orbitis internis externisque anguste, fascia transversa inter antennis, pronoto margine posteriore et margine anteriore late interrupto, mesonoto macula quadrata postice maculaque parva utrinque angulis posticis, postscutello fascia, segmento mediano fascia longitudinali utrinque, mesopleuris fascia verticali sub alis, segmento dorsali primo macula magna utrinque fasciisque angusta interrupta mediana, segmentis tertio, quarto quintoque fascia basali, sexto macula transversa basali, segmentis ventralibus 2-4 fascia lata emarginata, quinto fascia mediana, angusta, interrupta, femoribusque intermediis anticisque macula apicali flavis; alis subhyalinis, area radiali late infuscata, venis fuscis; mandibulis ferrugineis.

Long. 13 mm.

♀. Clypeus finely punctured, subcarinate longitudinally in the middle; front and vertex coarsely punctured, with sparse pale fulvous hairs; frontal prominence subtuberculate on each side on the inner side of the scape. Thorax closely and rather coarsely punctured, more finely and closely on the pronotum than elsewhere; median segment subcarinate in the middle at the base, a triangular space at the base much more finely punctured than the rest of the dorsal surface, the sides of the segment shallowly obliquely striated. Abdomen subling, finely and closely punctured, more strongly and sparsely on the ventral surface; sixth dorsal segment closely and finely longitudinally striated. Second cubital cell very long, the second abscissa of the radius nearly half as long again as the third; first recurrent nervure received at three-fifths from the base of the second cubital cell, second at two-fifths from the base of the third cubital cell.

Hab. River Mazaruni, British Guiana (*G. F. Bodkin*); November 1916.

This is a smaller species than *flavopicta*, Sm., and has the vertex much more closely punctured; the puncturation of the thorax is much closer and finer, the markings are somewhat different, there is no blue gloss on the abdomen, and the

second abscissa of the radius is much longer. In the latter character it resembles the Central-American *E. pulchra*, Cam., and *E. bicincta*, Sm., but differs from both in markings and in the finer and closer puncturation.

#### Family Sapygidae.

##### *Sapyga furtiva*, sp. n.

♀. Nigra; antennis ferrugineis, apice infuscatis; clypeo lateribus, fascia arcuata inter antennis, orbis internis anguste, orbis externis supra, pronoto margine antico late interrupto, mesopleuris macula sub alis, postscutello fascia transversa interrupta, segmento mediano macula magna apicali utrinque, segmentis abdominalibus 2-5 fascia lata transversa, sextoque dorsali macula magna ante apicem flavis; femoribus subtus, tibiis, tarsis, segmento dorsali primo fascia mediana, ventralique secundo basi ferrugineis; alis hyalinis, venis nigris, area radiali infumata.

Long. 11 mm.

♀. Mandibles very broad, tridentate at the apex; clypeus subrectangular, broader than long, the apical angles produced, longitudinally rugose. Head closely punctured-rugose; antennae thickened towards the apex, much stouter at the base than in *clavicornis*; posterior ocelli at least half as far again from the eyes as from each other. Thorax very closely punctured; abdomen shining, minutely and closely punctured. Second abscissa of the radius half as long as the third, more than twice as long as the first.

*Hab.* Simla Hills, 6300 ft.

Nearly allied to *clavicornis*, but differs in colouring, in the larger second cubital cell, and in the stouter basal joints of the flagellum.

#### Family Crabronidae.

##### Subfamily LARRINÆ.

##### *Dinorpha ruficaudata*, sp. n.

♀. Nigra; flagello fusco; scapo, mandibulis, pedibusque ferrugineis; tegulis fuscis, apice testaceis; segmentis abdominalibus 4-6 rufis; alis hyalinis, venis fuscis.

Long. 8 mm.

♀. Head sparsely punctured, the clypeus and front clothed with long cinereous hairs, clypeus very short, transverse at the apex, finely punctured and subcarinate in the middle; second joint of the flagellum distinctly longer than the third;

posterior ocelli twice as far from each other as from the eyes. Mesonotum shining, with scattered punctures, the anterior third closely punctured and clothed with cinereous hairs, which extend on to the pronotum, and more sparsely on to the mesopleuræ. Scutellum smooth and shining. Median segment strongly longitudinally striated, the space between the striae more finely transversely striated, forming reticulations. Abdomen shining, microscopically punctured. Radial cell very short, on the costal margin about twice as long as the third abscissa of the radius, and not more than half as long again as the apical margin of the cell; third abscissa of the radius half as long again as the second, but only one-third of the length of the second transverse cubital nervure.

*Hab.* Nyasaland, Zomba (*H. S. Stannus*).

The colouring of the abdomen is unusual in the genus. I use Jurine's name *Dimorpha* for the genus instead of *Astatus*, Latr., as to which there is some confusion.

*Notogonia nigricans*, Walk.

*Notogonia nigricans*, Walk. List of Hymen. in Egypt. p. 21 (1871). ♀.  
*Notogonia sculpturata*, Kohl, Ann. Naturh. Hofmus. Wien, vii. p. 221 (1892). ♂.

There is a co-type of Walker's species in the British Museum.

*Hab.* Egypt; Port Soudan; Albania; Gibraltar; St. Vincent, Cape Verde Islands.

*Notogonia palumbula*, Kohl.

*Notogonia palumbula*, Kohl, Ann. Naturh. Hofmus. Wien, ix. p. 364 (1894).  
*Notogonia punctipleura*, Cam., Sjöstedt, Kilimandjaro-Meru Exp. ii. p. 285 (1910). ♂.

This is merely the tropical subspecies of *nigricans*; the pygidial area of the female is narrower.

*Hab.* Cameroons; Kilimandjaro; Lake Nyasa; N.E. Rhodesia.

*Notogonia reticulata*, Cam.

*Leptotarra reticulata*, Cam. Ann. & Mag. Nat. Hist. (7) v. p. 31 (1900).

This is the Indian subspecies of *nigricans*, differing from the typical form in the rather finer punctures of the mesonotum.



*Hab.* Barrackpore, N.E. India; Matheran, W. India; Calcutta, Bengal.

Very closely allied to these three forms of *nigricans* is the Australian *N. reticulata*, Turn., in which the punctures of the mesonotum are almost obsolete and the eyes nearer to each other on the vertex. I do not consider that small differences in the comparative length of the abscissæ of the radius are to be relied on in this genus; there seems to be a slight individual variation in this respect. *N. malaysis*, Cam., from the Seychelles, differs from *reticulata* in the longer and rather narrower radial cell.

*Notogonia irritata*, Sm.

*Larrada irritata*, Sm. Cat. Hym. B.M. iv. p. 284 (1856). ♀.

*Larrada* (*Notogonia*) *fraudulenta*, Kohl, Ann. Naturh. Hofmus. Wien, ix. p. 303 (1894). ♀.

*Hab.* Senegal; Sierra Leone; Ashanti; Uganda.

*Notogonia creesus*, Sm.

*Larrada creesus*, Sm. Cat. Hym. B.M. iv. p. 284 (1856). ♀.

*Notogonia creesus*, Kohl, Ann. Naturh. Hofmus. Wien, ix. p. 309 (1894). ♀ & ♂.

*Motes tibiales*, Turn. Trans. Ent. Soc. London, p. 753 (1912). ♀.

Although the tarsal ungues are toothed in this species in the female, the very different form of the pygidial area shows that it is not closely related to *Motes*.

*Hab.* East Africa from Machakos to Witu; West Africa, Gambia and Gold Coast.

Doubtless this species ranges through the whole of tropical Africa.

*Notogonia deceptor*, Turn.

*Motes deceptor*, Turn. Ann. & Mag. Nat. Hist. (8) xvii. p. 253 (1916). ♀.

This is closely related to *N. creesus*, and is not a *Motes*. It may possibly prove to be a colour-variety of *creesus*, the structural differences being very slight.

*Tachysphex excelsus*, sp. n.

♀. Nigra; segmentis abdominalibus primo secundoque, tertioque dimidio basali rufis; alis subhyalinis, leviter infuscatis. Long. 12 mm.

♀. Clypeus broadly triangularly deflexed towards the

plex, the triangular surface shining, with large scattered punctures, the apical margin transverse. Eyes separated on the vertex by a distance equal to twice the length of the second joint of the flagellum; the third joint of the flagellum about as long as the first and second combined. Head and thorax very finely and closely punctured; median segment oblique, very finely granulate, the sides not striated; the posterior slope transversely stiolate towards the apex, with a deep depression at the base. Abdomen highly polished; pygidial area elongate, rather sparsely and finely punctured. The long spur of the hind tibiae distinctly shorter than the basal joint of the hind tarsus; spines of the fore tarsus forming a comb, slender and fairly long. Radial cell longer and narrower than in *T. pectinipes*; the second abscissa of the radius scarcely shorter than the third.

*Hab.* Tibet, Gyantse, 13,000 ft. (*H. J. Walton*); June.

The sculpture of the median segment resembles *T. latipennis*, Kohl, from which it differs in other details. The eyes are further apart on the vertex than in *T. pectinipes*, to which it is allied in the form of the pygidial area.

#### *Tachyspher filicornis*, Kohl.

*Tachyspher filicornis*, Kohl, Deutsch. Ent. Zeitsch. xxvii. p. 109.

This Mediterranean species occurs at Harar (*G. K. Johnston*). A subspecies occurs at Salisbury, Mashonaland (*G. A. K. Marshall*), in which the sculpture of the median segment is much coarser, there being very distinct divergent striae at the base, whereas the striae, as far as they are developed in *filicornis*, are parallel. For this I suggest the name *Tachyspher filicornis cecropius*, subsp. n.

I do not regard the sculpture of the median segment as a very reliable character in this genus, considering that it is liable to considerable variation in some species.

#### *Tachyspher aureipennis*, sp. n.

♀. Nigra; callis humeralibus, tegulis, abdomine, pedibusque rufo-testaceis; segmentis ventralibus nigro intaminatis; clypeo, fronte, thorace, segmento mediano, segmentisque dorsalibus marginibus apicali praecipue aureo-sericeo-pubescentibus; alis pallide davo-hyalinis, apice pallidissime infusentis, venis testaceis.

Long. 14 mm.

♀. Clypeus broadly rounded at the apex; eyes separated on the vertex by a distance not quite equal to the length of

the second joint of the flagellum. Thorax and median segment very closely and minutely punctured, rather thinly covered with very short, delicate, golden pubescence; the posterior slope of the median segment finely transversely striated, with a deep median sulcus. Pygidial area elongate-triangular, shining, sparsely and rather strongly punctured, very narrowly truncate at the apex. Comb of the fore tarsi long; tibiae with short golden pubescence. Radial cell rounded at the apex, not truncate, third abscissa of the radius longer than the second, which is equal to the space between the recurrent nervures on the cubitus. Tarsal unguis very long, as in the genus *Nitogonia*.

*Hab.* British East Africa, Simba, 3350 ft. (*S. A. Neave*), April; Makindu, 3300 ft. (*S. A. Neave*), April.

This seems to belong to the group of *T. quadriestor*, Gerst., but is a smaller and less robust species, and the eyes are nearer together on the vertex; the colour of the wings is also different. The elongate unguis are very remarkable.

*Tachysphex depilosellus*, sp. n.

♀. Nigra; mandibulis basi, clypeo dimidio apicali, scapo, flagello articulo primo, articuloque secundo basi, callis humeralibus, abdomine, pedibusque rufo-ferrugineis; alis anticis fuscis, posticis pallide fusco-hyalinis; venis nigris.

Long. 12 mm.

♀. Clypeus very broadly rounded at the apex, somewhat deflexed from the middle, the apical half shining, with a few large scattered punctures; the base of the clypeus and the front clothed with very short, sericeous, silver pubescence. Thorax closely microscopically punctured, the mesonotum and scutellum bare; dorsal surface of the median segment opaque, very closely and microscopically punctured, the sides of the segment obliquely, the apex transversely striated. Abdomen slender; pygidial area elongate-triangular, sparsely punctured. No pubescent fasciae on the dorsal segments. Tarsal comb long, the basal joint of the fore tarsus with eight spines. Radial cell broadly rounded at the apex; second abscissa of the radius longer than the third, which is longer than the space between the recurrent nervures on the cubitus.

*Hab.* N. Rhodesia, Pakasa (*O. Silverlock*); January.

A very slender species, easily distinguished by the fuscous wings from any other Ethiopian species with the abdomen red.

*Tachysphex brinckera*, sp. n.

♀. Nigra; mandibulis basi, tibiis anticis basi et subtus, tarsis anticis, tarsisque intermediis posticisque apice fusco-ferrugineis; segmentis abdominalibus primo secundoque rufo-ferrugineis; tegulis testaceis; alis flavo-hyalinis, apice pallidis; venis testaceis. Long. 13 mm.

♀. Clypeus broadly truncate at the apex, finely and closely punctured on the basal half; the apical half deflexed, shining, with large scattered punctures. Vertex very closely microscopically punctured; the eyes separated on the vertex by a distance slightly exceeding the length of the second joint of the flagellum; front and the base of the clypeus clothed with very short silvery pubescence, which is only visible in certain lights. Thorax minutely and closely punctured; median segment granulate, as long as the mesonotum, the sides and apex of the segment striated. Second and third dorsal segments with a little short silver pubescence at the apical angles; pygidial area elongate-triangular, sparsely punctured. Comb of fore tarsi long, basal joint of the fore tarsi with eight spines. Radial cell broadly rounded at the apex; second abscissa of the radius longer than the third, nearly twice as long as the space between the recurrent nerves on the cubitus.

*Hab.* Transvaal, Pretoria (*Miss J. Brincker*).

*Tachysphex punctata*, Sm.

*Laroda punctata*, Sm. Cat. Hym. B.M. iv. p. 282 (1856). ♂ (as ♀).

*Larra punctata*, Kohl, Verh. zool.-bot. Ges. Wien, xxxiv. p. 247 (1884).

The type is a male, not a female, and is a true *Tachysphex*. The wings are of a darker fuscous than in any other small black Ethiopian species of the genus known to me. Eyes separated on the vertex by a distance equal to about twice the length of the second joint of the flagellum.

*Tachysphex sulfuscatus*, sp. n.

♀. Nigra; segmentis abdominalibus duobus basalibus fusco-rufis; tarsis fusco-ferrugineis; alis subhyalinis, venis fuscis; clypeo, fronte, segmentisque dorsalibus tribus basalibus fascia apicali argenteo-pubescentibus; thorace rugose punctato; segmento mediano longitudinaliter striato-reticulato. Long. 9 mm.

♀. Clypeus broadly truncate at the apex, the apical

margin armed with a number of ill-defined teeth. Head closely and rather finely punctured; antennæ short and stout; eyes separated on the vertex by a distance slightly exceeding the length of the two basal joints of the flagellum. Thorax coarsely punctured-rugose; scutellum punctured; median segment irregularly longitudinally striate, with finer transverse striae, giving a reticulate appearance, which is more strongly developed on the more coarsely sculptured sides of the segment. Pygidial area smooth, rather broadly triangular. Legs slender; comb of the fore tarsi long; spur of the hind tibia much shorter than the basal joint of the hind tarsi. Radial cell broadly obliquely truncate at the apex; second and third abscissæ of the radius subequal.

*Hab.* Nyasaland, Mlanje, 2300 ft. (*S. A. Neave*); October.

*Tachysphex strigatus*, sp. n.

♀. Nigra; tarsis articularis apicalibus brunneo-ferrugineis; fronte opaque argenteo-pubescentibus; mesonoto crasse punctato, cinereo-pulso; segmentis dorsalibus tribus basalibus fasci interrupta apicali argenteo-pubescente; segmento mediano fortiter longitudinaliter striato; alis hyalinis, venis brunneo-ferrugineis; tegulis testaceis.

Long. 9-11 mm.

♀. Clypeus broadly subtruncate at the apex, the apical margin somewhat reflexed and with two blunt teeth on each side, closely and not very finely punctured. Front opaque, finely punctured-rugulose, the vertex closely and not very finely punctured. Eyes separated on the vertex by a distance half as great again as the length of the second joint of the flagellum. Mesonotum and mesopleuræ coarsely punctured-rugose; scutellum strongly but not very closely punctured. Median segment coarsely longitudinally striated, with finer, irregular, transverse striae between; the sides of the segment coarsely rugose-reticulate. Abdomen shining; pygidial area triangular, shining, with a few small scattered punctures. Radial cell rather broadly obliquely truncate at the apex; second abscissa of the radius a little longer than the third, equal to the distance between the recurrent nervures on the cubitus.

*Hab.* N.E. Rhodesia, between Fort Jameson and Lundazi, 4000 ft. (*S. A. Neave*), June; Central Angoniand, Lilongwe District, 4000-5000 ft. (*S. A. Neave*), May; Nyasaland, Mombera District, 4000 ft. (*S. A. Neave*), June; Nyasaland, Kotakota (*Dr. J. E. S. Old*).

Easily distinguished by the coarse sculpture of the thorax and median segment.

*Tachysphex vulneratus*, sp. n.

♀. Nigra; mandibulis basi, tegulis, tibiis tarsisque anticis, femoribus apice, tibiis intermediis et posticis subtus, tarsisque intermediis et posticis basi nigro intaminatis, brunneo-testaceis; segmentis abdominalibus quinto sextoque omnino, quartoque apice rufis; alis hyalinis, venis fuscis; fronte, clypeo, segmentisque dorsalibus tribus basalibus fascia apicali interrupta argenteo-pubescentibus; segmento mediano longius finaliter striato.

♂. Femine similis, tibiis tarsisque intermediis et posticis brunneo-testaceis; segmentis dorsalibus sexto septimoque omnino, quintoque apice rufis; fronte clypeoque aureo-pubescentibus.

Long., ♀ 10-11, ♂ 8-9 mm.

♀. Clypeus truncate at the apex, rather broadly depressed on the apical margin, with two minute teeth on each side. Head finely and closely punctured; eyes separated on the vertex by a distance not quite equal to the length of the second joint of the flagellum; antennae slender and rather long. Thorax closely and not very finely punctured; median segment strongly longitudinally striated, the sides of the segment more finely obliquely striated, the surface of the posterior truncation finely transversely striated. Pygidial area triangular, not elongate, shining, with a few scattered punctures. Comb of the fore tarsus long and slender; the long spur of the hind tibia almost as long as the basal joint of the hind tarsus. Radial cell long, rather narrowly rounded at the apex; third cubital cell about as long as the second, both on the cubitus and on the radius.

♂. Seventh dorsal segment broadly rounded at the apex; eighth ventral segment shallowly emarginate, the angles produced into distinct teeth.

*Hab.* N.E. Rhodesia, Niamadzi River, near Nawalia, 2000 ft. (*S. A. Neave*), August; Mid Luangwa Valley, 2000 ft. (*S. A. Neave*), July; Upper Luangwa Valley (*S. A. Neave*), August.

This differs from *strigatus* in colour, in the much finer sculpture of the thorax, in the lesser distance between the eyes, and in the long and slender antennae.

*Prosopigastra neavei*, sp. n.

♀. Nigra; mandibulis in medio, abdomine segmentis tribus basalibus, calcareibus, tarsisque articulis apicalibus ferrugineis; tegulis testaceis; alis hyalinis, iridescentibus, venis nigris.

♂. Feminae similis; segmentis abdominalibus 5 apicalibus nigris; tarsis ferrugineis; tibiis basi albido-maculatis.

Long., ♀ 7-8, ♂ 6 mm.

♀. Clypeus very widely arcuately deflexed towards the apex, the deflexed portion smooth and shining, the apical margin subtruncate. Eyes separated on the vertex by a distance equal to about four times the length of the second joint of the flagellum; head very distinctly but not very closely punctured; a smooth convex area between the anterior ocellus and the base of the antennæ. Thorax rather more strongly punctured than the head, the individual punctures large and clearly separated. Median segment scarcely more than half as long as the mesonotum; the dorsal surface margined by carinæ at the sides and apex, irregularly and coarsely striate-reticulate; the sides of the segment longitudinally striated, the posterior slope rugose. Abdomen closely and finely punctured; pygidial area shining, sparsely punctured, very narrowly truncate at the apex. Comb of the fore tarsi long and slender. Radial cell short, very broadly obliquely truncate at the apex; second and third abscissa of the radius subequal, each at least half as long again as the fourth.

♂. Seventh dorsal segment broadly rounded at the apex; eighth ventral segment emarginate, testaceous, the apical angles produced into short spines. Eyes separated on the vertex by a distance not exceeding half the length of the second joint of the flagellum.

*Hab.* N.E. Rhodesia, Mid Luangwa Valley, about 2000 ft. (*S. A. Neave*), July and August; Nyasaland, between Ft. Jameson and Dowa, 4000 ft. (*S. A. Neave*), October.

The sexual divergence in the distance between the eyes on the vertex is greater than in any Mediterranean species of the genus.

#### Subfamily *TRYPOXYLONINÆ*.

##### *Pison papuanum*, Schulz.

*Pison papuanum*, Schulz, Berlin. Ent. Zeit. xlix. p. 217 (1904).

*Pison morosus*, Sm. Journ. Linn. Soc., Zool. viii. p. 86 (1864). ♀ (nec Sm. 1856).

*Pison constrictum*, Turn. Ann. & Mag. Nat. Hist. (8) ix. p. 201 (1912).

♂.  
*Pison constrictum*, Turn. Proc. Zool. Soc. London, p. 627 (1916).

I had overlooked the name *papuanum* in my recent paper on *Pison*.

XXVIII.—*A new Tuberculate Terrestrial Isopod from New Zealand.* By CHAS. CHILTON, M.A., D.Sc., M.B., C.M., LL.D., C.M.Z.S., Professor of Biology, Canterbury College, New Zealand.

[Plate XIII.]

IN 1915\* I described a tuberculate species of *Cubaris* from New Zealand under the name *C. suteri*. Of this species I had only the one specimen, and I stated that of a second tuberculate species, *C. hamiltoni*, only a single specimen was known, these facts showing that our knowledge of the terrestrial Isopoda of New Zealand was still very incomplete. I suggested also that a careful survey, especially in the forests of the North Island, might bring to light other interesting species. This has already proved to be the case, and I have recently received from Mr. David Miller, of the New Zealand Agricultural Department, several specimens of another tuberculate *Cubaris* found under the bark of fallen logs in the bush at Levin, Wellington. Of this species Mr. Miller was fortunate enough to find eight specimens. In general appearance, colour, markings, etc., they are very similar to *Cubaris suteri*, and I at first thought that they might perhaps be specimens of this species with the tubercles on the dorsal surface better developed than in the type-specimen. This, however, proves not to be the case, as the tubercles, or, rather, ridges, are arranged differently, and I am therefore describing the specimens as a new species, which I have much pleasure in naming after their discoverer.

*Cubaris milleri*, sp. n. (Pl. XIII. figs. 1-6.)

*Specific description*.—Oblong-oval, breadth about half the length. Epimeral portions fairly well developed, especially in the first segment of the pereon; central portion of each segment very convex and marked off from the lateral portions by a longitudinal ridge or flange on each segment (figs. 1 & 2). Head with the anterior margin produced upwards into a well-defined ridge projecting slightly above the dorsal surface and having the upper margin regularly convex and without any notch; the posterior surface of the head is produced dorsally into a distinct transverse flange rising high above the general surface and showing in front view much higher than the

\* Journ. Linn. Soc. vol. xxxii. p. 425, pl. xxxvii. figs. 24-28.



anterior margin; the flange has a slight depression in the centre, so that its upper margin is concave (fig. 3). Each segment of the pereon bears a pair of longitudinal tubercles or ridges, which are low anteriorly but become higher towards the posterior part of the segment; these ridges increase in size and distinctness on the posterior segments until, in the seventh segment, the ridge is much higher than the segment itself and projects backwards over the pleon. In dorsal view these ridges form an almost continuous row, separating the central part of the body from the lateral portions. In each segment there are a few small tubercles or irregularities both on the lateral portions below the ridge and also on the central part between the ridges. Inferior margin of first segment of pereon deeply cleft posteriorly, the cleft extending nearly halfway along the whole margin; inferior margin of the second segment with a distinct tubercle on its inner surface enclosing a wide notch for the reception of the succeeding segment when the animal is rolled up into a ball (fig. 4). The pleon bears no ridges and shows the usual characters; the posterior segment has the hind margin either straight or very slightly concave (fig. 5).

Antennae (fig. 3) of normal shape, the second and third segments of peduncle subequal, the fourth a little longer and the fifth nearly twice as long as the fourth; flagellum a little shorter than the fifth joint of peduncle, its first joint about one-third the length of the terminal joint.

The mouth-parts show the usual structure common to the genus, and do not appear to present any distinctive characters.

The legs are all short and of the usual form. In the single male dissected the anterior pairs do not show any special modification; but as the specimen is small and the legs imperfect the evidence on this point is not quite conclusive.

The pleopoda of the male do not appear to differ in any important points from those of other species of the genus.

The uropoda (figs. 5 & 6) have the endopod very short, almost knob-shaped, extending only a short distance from the base; its extremity bears two or three minute setae. The exopod is also very small, reaching only about halfway from its attachment to the posterior end of the peduncle; it bears a rather long seta, which reaches nearly as far posteriorly as the peduncle.

Under a high power the whole integument shows minute scale-like markings.

*Colour.* Pale reddish brown, with marblings of a darker brown.

Length of largest specimen about 7 mm.

Loc. Under the bark of fallen logs in the bush, Levin, Wellington, N.Z.

This species appears to be closely related to *Cubaris suteri*, Chilton, the structure of the lateral margin of the first and second segments of the pereon and of the uropoda being closely similar in the two species. In *C. suteri*, however, the ridges are transverse and mainly confined to the posterior border of the pereon segments, while in the present species the ridges are longitudinal, extending along nearly the whole of the length of each segment, and they are much better developed and consequently more prominent. Another tuberculate species, *C. hamiltoni* (Chilton)\*, probably also comes near to these two species; but the dorsal surface is much more profusely supplied with flanges or ridges and with pointed tubercles. *C. hamiltoni* is known only from the single type-specimen which was obtained in the neighbourhood of Petane, near Napier, in New Zealand, and this specimen is unfortunately somewhat imperfect, so that our knowledge of the species is far from complete. The only other tuberculate species known from New Zealand is *C. macmahoni* (Chilton), originally described from Kenepuru in Marlborough, though I have since had specimens sent to me from one or two localities in the North Island. *C. spinosus* (Dana) is a spiny species, "the body bristled throughout with subacute spines"; but it is only known from Dana's brief description and figures, no specimen having been since collected. It was found by Dana near the Bay of Islands.

I am much indebted to my assistant, Miss E. M. Herriott, M.A., for preparing the drawings to illustrate this paper.

#### EXPLANATION OF PLATE XIII.

(All the figures refer to *Cubaris milleri*, sp. n.)

- Fig. 1. Dorsal view of whole animal.  
 Fig. 2. Side view of animal (antennae and legs not shown).  
 Fig. 3. Front view of head with antennae etc., the flange arising from the posterior border of the head showing behind the anterior margin.  
 Fig. 4. Lateral margins of pereon segments 1, 2, and 3, from below.  
 Fig. 5. Terminal portion of pleon, from above.  
 Fig. 6. Uropoda and terminal segment, from below.

\* See Trans. Linn. Soc., Zool. vol. viii. pp. 99-152, pls. xi.-xvi., and Trans. N.Z. Inst. vol. xlii. pp. 286-291.

XXIX.—*South-African Talitridæ.*

By the Rev. THOMAS R. R. STEBBING, M.A., F.R.S.

ON Christmas Eve in 1916 Mr. H. W. Bell-Marley, of Durban, Natal, obtained some specimens of *Talitridæ* at Eshowe Bush, 1800 feet above sea-level. Of those which he has kindly forwarded to me most are females, but one or two males among them, though less in size than many of the other sex, will, I think, settle a question which has long been obscure. The species is clearly that which Spence Bate in 1862 named *Talorchestia ? africana*. Clearly, also, it may now be referred to the genus named *Talitriator* by Methuen in 1913, and more fully defined by Barnard in 1916.

## Genus TALITRIATOR, Methuen.

1913. *Talitriator*, Matthews, P. Z. S. Lond. p. 109.1916. *Talitriator*, Barnard, Ann. S. African Mus. vol. xv. pt. 3, p. 222.

Related to *Talitrus* by feeble minutely chelate second gnathopods in both sexes; distinguished from it by the first antennæ nearly as long as the peduncle of the second; maxillipeds with small fourth joint to the palp; first gnathopod shorter than second; fifth side-plates of peræon more unequally bilobed; telson longer than broad.

Of these characters, the last two seem to be scarcely of generic importance. Spence Bate considers the fifth side-plate to be equally bilobed in *Talitrus*; but neither his own figures nor the facts support this statement.

*Talitriator africanus* (Bate).1862. *Talorchestia ? africana*, Bate, Amphipodous Crust. Brit. Mus. p. 15, pl. ii. figs. 6, 6i, 6h.1906. *Talorchestia ? africana*, Stebbing, 'Das Tierreich,' Lief. 21, p. 554.1910. *Talorchestia ? africana*, Stebbing, Ann. S. Afr. Mus. vol. vi. pt. 4, p. 459.1912. *Talitrus ? africanus* (Bate), Calman, Ann. & Mag. Nat. Hist. ser. 8, vol. x. p. 135 (1912).1913. *Talitriator eastwoodæ*, Methuen, P. Z. S. Lond. p. 110, pls. x, xi.1916. *Talitriator eastwoodæ*, Barnard, Ann. S. Afr. Mus. vol. xv. pt. 3, p. 223 (and *Talorchestia ? africana*, p. 215).

In the male specimen the flagellum of the first antennæ has ten joints, in the female eleven, in both sexes the third joint of the peduncle is the longest, in the second antennæ the flagellum of the male has 22, the larger female 23 joints. The palp of the first maxilla is minute. Of the customary

three teeth on the inner plate of the maxillipeds two are very conspicuous, but the innermost small, as shown by Methuen.

For the second gnathopod Methuen gives "coxal plate excavate behind with conical projection." Barnard mentions this as having specific value in the genus and as excluding the typical species from *Talitrus*. It is, however, found in *T. albuaudi*, Chevrenx, 1896. Methuen states that the first pereopod is not quite as long as the second. This, surely, is an accidental reversing of the true relation. For the great size of the anterior lobe of the fifth side-plate there is a parallel in *T. albuaudi*. Our specimens show four pairs of spines on the telson, while Methuen's figure shows only two pairs; but Barnard supposes that Methuen's specimens were probably not quite mature. A fine red colour was retained by Mr. Bell-Marley's specimens as received nearly two months after capture. As this is probably a terrestrial species, it is desirable to point out that in Methuen's notes on distribution the word "depths" has by some mischance been substituted for "heights" in the quotation from 'Das Tierreich.'

XXX.—*New Species of Indo-Malayan Lepidoptera.*  
By Colonel C. SWINHOE, M.A., F.L.S.

*DANAINÆ.*

*Salatura plecippus aduana*, nov.

♂ ♀. A local race of *plecippus*, uniformly smaller; all the black vein-markings narrower; the black apical portion of the fore wing broader, consequently the bronzy-red interspace between veins 2 and 3 much shorter; no indication of the small similarly coloured space always present in *plecippus* in the next upper interspace, just outside the cell-end, and the series of subapical bars all much shorter.

Expanse of wings, ♂ 2 $\frac{8}{10}$ , ♀ 3 inches.

*Hab.* Luzon.

Staudinger refers to this local race in 'Iris,' 1889, p. 28.

*ETPLINÆ.*

*Isamia electa*, nov.

♂. Upperside dark blackish brown: fore wing paler on the outer third, the inner two-thirds with a slight blue-black

gloss; a minute blue-grey spot at the lower end of the cell, another outside it in the interspace above vein 4, and another above the upper end of the cell close to the costal margin: hind wing with the costal space whitish, descending a little into the cell; a very faint series of blue-grey dots close to the outer margin; no other markings on either wing. Under-side fairly uniform blackish brown, paler than it is above; fore wing with the hinder marginal space whitish; spots larger and more prominent, one at the lower end of the cell, another beyond it; a rather long oval spot in the interspace above vein 2, a small spot outside it, and three small spots close to the margin above the hinder angle, and two small spots at the base of the wing: hind wing with three basal small spots, one at the end of the cell, five in a line in the interspaces 2, 3, 4, 5, and 6, a submarginal spot in interspace 2, two close together in interspace 3, and one in interspace 4; a series of somewhat larger spots close to the margin in the interspaces up to interspace 4; cilia with white dots in the interspaces both above and below. Head with three white spots on each side; thorax above with a white central line; below, palpi with a white spot between them and one on each side, thorax covered with white spots, and the abdomen with a central row of larger spots.

Expanse of wings, ♂, 4 inches.

*Hab.* Palone, Burma, June 1887.

#### PIERINÆ.

##### *Hebomoia solemonensis*, nov.

♂. Fore wings with the orange apical portion occupying more than one-third of the wing, extending well into the cell, filling up very nearly the whole of interspace 3 and the outer and upper half of cell 2; the costal band very narrow, blackish grey powdered with ochreous, thickens a little at the apex, runs down the outer margin very narrowly, and ends in a blackish suffused small patch just above the hinder angle; the interior blackish band which usually limits the orange portion entirely absent; the submarginal blackish spots in the orange patch spear-shaped and very pale; hind wings without any marginal band. Head and body powdered with ochreous.

Expanse of wings, ♂,  $3\frac{2}{3}$  inches.

*Hab.* Solomons.

##### *Madais vi*.

*Teracolus vi*, Swinhoe, P. Z. S. 1884, p. 437, pl. xxxix. figs. 6, 7.  
*Teracolus immaculata*, Rober, Seitz. Macro. Lep. i. p. 56.

My type came from the vicinity of Aden in Arabia, Rober's type from Syria; I have both in my museum, and there can be no doubt they are identical. *Teracolus vi* is not mentioned in Seitz.

#### Family Aganaidæ.

##### *Asota lara*.

*Hypsa lara*, Swinhoe, Ann. & Mag. Nat. Hist. (6) xii. p. 215 (1893).

*Aganais intacta*, var., Snellen, Tijd. voor Ent. xxxi. p. 133, pl. ii. fig. 4 (1888).

##### *Hub.* Java.

It is a good species, quite different to *intacta*, Walker, having a broad, central, longitudinal stripe on the fore wing; it is apparently quite common in Java; I have received several examples from Mt. Gedé and Buitenzorg.

#### Family Drepanidæ.

##### *Seica orbiferata*.

*Abraxas orbiferata*, Walker, xxiv. 1126 (1892).

*Argyris insignata*, Moore, P. Z. S. 1867, p. 645.

*Platypteryx edicoides*, Snellen, l. c. xxxii. p. 9, pl. i. fig. 3 (1889).

##### *Hub.* Sarawak, Borneo (type in B. M.).

The type of *insignata* in the B. M. is marked "Bengal." Snellen's type is from Java. I have it from Mene, Shan States (*Munders*), and from Kina Balu, Borneo (*Everett*). They are all very similar.

##### *Trotilia argentilinea*.

*Trotilia argentilinea*, Walker, xxxii. 394 (1865); Swinhoe, Cat. Het.

Mus. Oxon. i. p. 244, pl. vii. fig. 13, ♂ (1892).

*Platypteryx argentilinea*, Snellen, l. c. p. 8, pl. i. fig. 2, ♀ (1889).

##### *Hub.* Singapore (type ♀ in Mus. Oxon.).

It is also from Sula in Mus. Oxon. (a ♂). Snellen also described his type from Java as *argentilinea*.

#### Family Lasiocampidæ.

##### *Sitina cingra*, nov.

♀. Palpi black, with some white hairs on its upperside; head and thorax covered with long ochreous-white (nearly pure white) hairs; abdomen black; anal tuft white: fore wing black, irrorated with very minute white atoms; a large round black spot with a white line through it at the end of

the cell; an antemedial, sinuous, transverse white line; a postmedial diffuse white band, narrowing hindwards, and through it a black dentate line, curved outwards below the costa, its points outwards; a series of black lunules with white outer edges close to the margin; cilia with some white spots: hind wing paler, uniform in colour, without irrorations, a white waved band across its middle from the middle of the costa to the abdominal margin near the anal angle; cilia white, with pale blackish spots. Underside uniformly coloured like the upperside of the hind wing; a rather broad white band across both wings, evenly outwardly curved, postmedial on fore wing, medial on hind wing; the marginal marks on both wings as on the upperside. Body and legs black, with white hairs; abdomen with white lateral bands.

Expanse of wings  $1\frac{1}{2}$  inch.

*Hab.* N. Gippsland, Victoria (*H. W. Davey*).

It is unnamed in the B. M.

*Stina epipasta*, nov.

♀. Palpi ochreous brown; head and shoulders covered with white hairs; thorax black, with ochreous-grey hairs; abdomen black, with some ochreous-grey hairs on the first two segments, small tufts of white hairs on the middle of the last two segments and on each segment at the sides; anal tuft white: fore wing grey, darkest on the middle of the costa, blackish on the basal half of the hinder margin, the wing covered with minute white irrorations, dense at the base and on the lower half of the middle; below the cell a white, sinuous, transverse, antemedial line; a small white lunular mark at the end of the cell; a postmedial band of grey lunules outwardly edged with white; a submarginal row of black lunules, outwardly edged with white; veins brown, finely marked with white: hind wing uniformly grey, with a nearly straight white band from the middle of the costa to the abdominal margin above the anal angle; cilia of both wings grey. Underside coloured uniformly grey as on the upperside of the hind wing; a transverse medial white band on both wings, nearly straight on fore wing, outwardly and evenly curved on hind wing. Body colorous with the wings: abdomen with the lateral white spots continued into segmental bands, its anal segment white; legs with white hairs.

Expanse of wings  $1\frac{6}{10}$  inch.

*Hab.* Yackandandah, Victoria (*H. W. Davey*).

## Family Deilemereidae.

*Deilemera luzonica*, nov.

♀. Belongs to the *evergista* group, nearest to *ceres*, Boisduval, and *gera*, Swinhoe (Trans. Ent. Soc. 1903, p. 63, pl. iv. fig. 1); fore wing of the same blackish-brown colour; a longitudinal white streak near the base, shorter than in *gera*, with a small white spot below it near the base; a very large white patch with waved outer side, commencing at the upper end of the cell in a narrow rounded form, broadening hindwards to the internal vein; its inner side is slightly excavated at the lower margin of the cell, and then runs inwards below the outer end of the basal streak, occupying a large portion of the central space of the wing; two large white, rounded, submarginal spots as in *gera*, but much larger: hind wing with a narrow costal blackish-brown band and an even outer marginal band, as in *gera*, with a submarginal white spot in it, a little below the apex. Head and body yellow; collar with two black spots; thorax covered with short green scales; abdomen with broad black segmental bands.

Expanse of wings  $1\frac{8}{10}$  inch.

*Hab.* Luzon, Philippines.

*Deilemera purata*, nov.

♀. Milk-white; palpi white, the last joint black; top of head with a black spot, two on the collar; thorax with a black medial line, and another thinner line on each side of it; abdomen with a dorsal row of pale blackish spots; legs white, without markings: fore wings with the veins grey, a darker grey blotch or patch at the lower end of the cell: hind wing with dark grey streaks at the vein-ends, decreasing in size hindwards. Underside with all the vein-ends grey and a large space on the fore wing blackish from the base to the end of the cell, extending upwards to the costa, the veins through this black space white.

Expanse of wings  $1\frac{5}{10}$  inch.

*Hab.* Luzon, Philippines.

Figured by Semper as a female aberration\* of *Deilemera sonticum*, Swinhoe, also from the Philippines; but I have in my museum both sexes of *sonticum* from Mindanao and Luzon. The sexes of that species are alike and are widely different from this form, though the palpi, head, and body are similarly marked.

\* Phil. Schmett. pl. lviii. fig. 7 (1899).



## Family Lymantriidæ.

*Euproctis servilis*.*Euproctis servilis*, Walker, xxxii. 350 (1865). ♂.*Dardala prima*, Walker, xxxv. 1917 (1866). ♂.*Euproctis incompta*, Snellen, Tijds. voor Ent. xx. p. 9, pl. i. fig. 2 (1879). ♂.*Euproctis flavipennis*, Snellen, l. c. xxii. p. 107, pl. ix. fig. 1 (1879). ♀.*Euproctis cinerea*, Heylaerts, Ann. Soc. Ent. Belg. xxxvi. p. 10 (1892).*Euproctis nurma*, Druce, Ann. & Mag. Nat. Hist. (7) iii. p. 469 (1899).

Type ♂, Celebes, in Mus. Oxon.

Type ♂ *prima*, Celebes, in Mus. Oxon.Types ♂ *incompta*, Java, in coll. Snellen.Type ♀ *flavipennis*, Makassar, Celebes, in coll. Snellen.Type *cinerea*, Java.Type *nurma*, Timor, in coll. Joicey.

As stated in my monograph of this family in Trans. Ent. Soc. 1903, p. 420, the colour of the fore wings varies much, from pale yellow to olive-brown, and the hind wings from yellow to white. I have the two extremes from the same locality; I have received it from Celebes, Java, Talaut, and Kina Balu, Borneo: the markings are all identical.

## Family Hadenidæ.

*Cirphis philippensis*, nov.

♂ ♀. Palpi, head, body, and fore wings brownish ochreous, much as in the common *C. loreyi*, Dup.: fore wing with a narrow white streak along the median vein to the end of the cell, with some blackish scales below its basal half; narrower white streaks on all the other veins, and still narrower (very fine) streaks in all the interspaces; some blackish scaling on the basal half of the hinder margin; a small black mark at the lower end of the cell, at the end of the white streak first mentioned, a black dot in the interspace below the middle of the cell, and another in the same interspace more than half the distance between it and the outer margin, some black points on the outer margin; cilia brownish ochreous, variegated by the white streaks running into it: hind wings pure white, without any markings. Underside with the fore wing paler, with the white streaks less distinct and a black spot one-sixth before the apex, close to the costa.

Expanse of wings, ♂ ♀, 1  $\frac{2}{10}$  inch.

*Hab.* Luzon, Philippines.

## Family Catocalidæ.

*Attatha flavata*, nov.

♀. Head and body yellow; collar black; a broad black band across the middle of the thorax; a square black patch at the base of the abdomen: fore wings bright yellow; a short black streak from the base; a long black streak on the hinder margin, not reaching the base nor the hinder angle; a black band from the middle of the costa, narrowing hindwards to near the hinder angle, and a triangular black patch from the costa near the apex, much as in *A. regalis*, Moore, from India; four black spots on the lower portion of the outer margin: hind wing paler yellow, with a marginal series of small black spots. Underside dull yellow, quite uniform in colour; a rather large, quadrate, blackish patch at the end of the cell; small black marginal spots on the hind wing.

Expanse of wings, ♀,  $1\frac{6}{10}$  inch.

*Hab.* Manila; two examples received from Herr Semper as *A. flavata*, Semper incl., but has never been published.

*Attatha coccinea*, nov.

♀. A larger insect than *flavata*; head and thorax yellow; frons black; collar, middle band across thorax, and patch at base of abdomen black as in *flavata*; abdomen scarlet: fore wing bright yellow, the bands and streaks as in *flavata*; the apical patch not excavated on its outer side as in *regalis*, the central band narrower: hind wing scarlet, marginal spots small and black. Underside: both wings and body and legs uniform scarlet; fore wing with a dark black patch at end of cell as in *flavata*, but blacker, no black patch in the middle of the outer margin as in *regalis*, one black spot at the end of vein 3, and a series of black spots on the outer margin of the hind wing; the subterminal large black spot in *regalis* near the anal angle on the upperside not present.

Expanse of wings, ♀,  $1\frac{7}{10}$  inch.

*Hab.* Luzon (Semper).

## Family Stictopteridæ.

*Stictoptera poliata*, nov.

♀. Head, body, and fore wings dark grey, covered with blackish irrorationes, which are uniformly distributed throughout the fore wings except in the middle of the wing, through which there is a prominent black thick line, uniform, and evenly outwardly curved, marginal points black: hind wings with

broad and even black border, which occupies nearly half of the outer portion of the wing; a black cell-spot and black veins; cilia grey. Underside paler grey, with very broad black borders to both wings: fore wings with a black discoidal spot and another above it close to the costa: hind wings with a large black discoidal spot.

Expanse of wings  $1\frac{1}{2}$  inch.

*Hab.* Singapore.

Received with several examples of *S. plagifera*, Walker, Journ. Linn. Soc. vii. p. 187 (1861), and described by Walker as a *Thermesia*; type in Mus. Oxon., and apparently overlooked and omitted in Phal. xi.

*Stictoptera wetterensis*, nov.

♂. Fore wing narrow and long, the outer margin very oblique and but slightly convex; head, body, and fore wing dark pinkish grey, thickly irrorated with black atoms: fore wing with a short black linear mark below the cell-end, a shorter one at the end, a transverse similar mark near the hinder angle, a longer similar mark parallel with the costa at the apex, and an obscure blackish mark near the hinder margin one-third from the base: hind wing dull white, the veins black; a fairly broad even black band on the outer margin. Underside dirty white, all the veins black: fore wing nearly all blackish, the whitish part confined to the space below the cell: hind wing with a discoidal black line and blackish borders as on the upperside.

Expanse of wings  $1\frac{1}{2}$  inch.

*Hab.* Wetter Island, South-west Islands, Amboina.

The Amboina examples are almost identical with that from Wetter; when more material comes to hand the genitalia must be examined to determine its exact position.

*Stictoptera tongloana*, nov.

♂. Head, body, and fore wings greyish brown with a slight pinkish tinge: fore wings with a number of indistinct, transverse, blackish, waved lines; a black spot inwardly white-edged at the end of the cell, a small black mark below the cell beyond its middle, another rather larger beyond it, with a small one above it continued upward in a waved linear form to near the costa, a similar submarginal disjointed row of black marks, and two black round spots at the apex; all the other marks more or less lunular and encircled by a paler ground than that of the rest of the wing; a row of pale blackish lunules, inwardly pale-edged, close to the outer

margin, and small dark black lunules, inwardly pale-edged, on the margin: hind wings smoky white, veins black; a very broad, even, black marginal band, occupying one-third of the wing-space; cilia white. Underside much as in *wetterensis*.

Expanse of wings  $1\frac{1}{2}$  inch.

*Hab.* Tonglo, Solomon Islands.

*Stictoptera dispar*, nov.

♂ ♀. Palpi, head, body, and fore wings dark chocolate-brown, nearly black; palpi grey in front: fore wing with the base and outer portions slightly paler, markings very indistinct; a transverse, somewhat oblique, and very indistinct band, postmedial, parallel with the outer margin, and beyond the reniform, a paler band adjoining its outer side somewhat reddish-tinged, with some obscure black spots in it, and black lunular marks on the margin: hind wings smoky white, the veins black; outer margin broadly and evenly black, occupying more than one-third of the wing. Underside of the usual pattern, but the fore wing has four rather prominent white spots on the costa before the apex, and the hind wing a prominent discal lunular bar which runs up to the costa.

Expanse of wings  $1\frac{9}{10}$  inch.

*Hab.* Mt. Keber, Brit. N. Guinea, 6000f.

I have four examples which I received as *S. macromma*, Stollen (from Celebes), but they do not correspond with Stollen's figure or description, or with Hampson's description in *Phil.* xi. p. 162.

*Stictoptera commutata*, nov.

♀. Fore wings much as in *dispar*, but there is a very large round white spot below the cell at the base of vein 3, which slightly enters the cell and also slightly crosses vein 2; at the base of the wing there are some dull ochreous scales and dull ochreous hairs covering the upper sides of the thorax, two spots behind, and some on the first two segments of the abdomen: hind wings and underside as in *dispar*.

Expanse of wings  $1\frac{9}{10}$  inch.

*Hab.* Mt. Keber, Brit. N. Guinea, 6000f.

Two examples.

Family Epiplemidæ.

*Epiplema rhacina*, nov.

♂. Upperside of a uniform olive-brown colour: fore wing with the basal half of the costa irrorated with dark brown; a

double ring-shaped mark somewhat like a figure of 8 in the cell, another at its end, and a third below the end, the last two more or less connected; the basal half of the fore wing is finely striated with brown thin striations; there are indications of an outwardly curved brown antemedial line on the fore wing, and a sinuous outwardly curved middle line connected with the two outer ring-marks; both wings with a postmedial line, sinuous in the fore wing, its upper half very deeply outwardly curved, double on the hind wing, wavel and very slightly outwardly curved; a row of submarginal brown spots on both wings; outer margin of the fore wing somewhat excavated below the apex as in *E. moza*, Butler\*, but not so deeply, and the two tails of the hind wing blunt and very short. Underside pale pinkish grey, both wings with discoidal marks, double brown transverse lines rather close together, and minute submarginal spots.

Expanse of wings  $1\frac{2}{3}$  inch.

*Hab.* Khasia Hills.

#### Family Pyralidæ.

##### *Crithote horridipes*.

*Crithote horridipes*, Walker, Journ. Linn. Soc., Zool. vii. p. 188 (1844).  
*Selenis crinipes*, Snellen, Tijds. voor Ent. xxiii. p. 100, pl. viii. figs. 4, 4a (1880).

Type, Sarawak, Borneo, in Mus. Oxon.

Type *crinipes*, Bonthain, Celebes, in coll. Snellen.

Apparently a very widely distributed species. I have it from Gilolo, the Khasia Hills, and from N. Kanara, S. India; there is no appreciable difference in any of them.

##### *Avitta subsignans*.

*Avitta subsignans*, Walker, xv. 1675 (1858).  
*Oreola surrigens*, Walker, Journ. Linn. Soc., Zool. vii. p. 81 (1861).  
*Epizena inductalis*, Snellen, Tijds. voor Ent. xxiii. p. 130 (1880), and xxiv. p. 68, pl. vi. fig. 8 (1881).  
*Avitta fasciosa*, Moore, Descr. Ind. Lep. Atk. p. 194, pl. vi. fig. 26 (1882).

Type, Kanara, S. India, in B. M.

Type *surrigens*, Sarawak, Borneo, in Mus. Oxon.

Type *inductalis*, Makassar, Celebes, in coll. Snellen.

Type *fasciosa*, Khasia Hills, in coll. Staudinger.

Another widely-spread species. Snellen records it from Java, and I have received it from Sumba Island, Java, Goping, Perak, Coomoo (Queensland), the Andaman Islands,

\* Ann. & Mag. Nat. Hist. (5) i. p. 402 (1878).

Bombay, Nilgiri Hills, and the Khasia Hills—all apparently identical; whether the examination of the genitalia will bear this out remains to be proved.

*Osericana albistella*.

*Osericana albistella*, Walker, xxxiv. 1214 (1865).

*Pavonia pupillalis*, Snellen, Tijds. voor Ent. xxviii. p. 7, pl. i. fig. 7 (1855).

*Hab.* Sumatra.

Both types are from Sumatra. I have also a pair from Nias. The fore wing of the male is much paler than that of the female, the hind wing of both sexes very pale in colour.

*Osericana albistella trypheropa*, nov.

♂ ♀. Both wings of a uniform purplish grey, the hind wing perhaps a shade lighter in colour than the fore wing, the pectinations of the long antennæ more robust than in *albistella*, the markings similar.

Expanse of wings, ♂ ♀,  $1\frac{9}{16}$  inch.

*Hab.* Palawan, Philippines; 1 ♂, 3 ♀.

*Osericana albistella syntypistis*, nov.

♂ ♀. Uniformly smaller than either of the foregoing forms; the colour of the hind wing about the same as in *trypheropa*, the colour of the fore wing very much darker; the abdomen with more greyish suffusion, the yellow anal tuft entirely black on the upperside; in the other two forms there are only a few blackish hairs.

Expanse of wings, ♂  $1\frac{7}{16}$ , ♀  $1\frac{2}{16}$ – $1\frac{9}{16}$  inch.

*Hab.* Lawang, E. Java; 1 ♂, 4 ♀.

*Simplicia schalldusalis*.

*Bocana schalldusalis*, Walker, xvi. 180 (1858).

*Calceps linearginata*, Walker, Journ. Linn. Soc. vii. p. 178 (1865).

*Simplicia infauata*, Felder, Reise Nov., Lep. pl. exx. fig. 45 (1873).

*Nabortha marginata*, Moore, Lep. Ceylon, iii. p. 234, pl. clxxvii. fig. 2 (1885).

*Simplicia grisecolimbis*, Snellen, Tijds. voor Ent. xxix. p. 47, pl. ii. fig. 4 (1886).

*Hab.* Walker's and Felder's types are from Sarawak, Borneo, Moore's from Ceylon, and Snellen's from Sumatra. It appears to be a very widely spread form; I have it also from the Solomons and from Obi Island in the Moluccas, and without examining the genitalia I can find no difference between them.

Family **Pyraustidæ.**

**MARGARONINÆ.**

*Margaronia alboscapularis*, nov.

*Glyphodes alboscapularis*, Kenrick, MS.

♂ ♀. Upperside: head and shoulders black; a white spot on the collar; body black, a short tuft of white hairs on each side from the base of the thorax: fore wings black; a white spot below the costa a little before its middle; a large, oval, discal white patch as in *M. doleschali*, Lederer; hind wings white, with a broad black band, narrowest on the costa, very broad at the apex, narrowing somewhat hindwards to the anal angle. Underside: palpi and body white; abdomen of the male with some black marks, anal tuft black, of the female with the lower half black; legs white.

Expanse of wings, ♂ ♀,  $1\frac{2}{3}$ – $1\frac{4}{5}$  inch.

*Hab.* Ekeiki, Mt. Kebea, Brit. Cent. N. Guinea.

A fine series of both sexes, allied to *M. doleschali*, Lederer, but is easily distinguishable by its white hind wings, *doleschali* having black hind wings, with a very large, almost round, white spot.

**SYLEPTINÆ.**

*Sylepta zarialis*, nov.

♂. Cream-coloured, almost pure white, but not shining; palpi chocolate-brown above: fore wing with the costa pale chocolate, outer marginal fine line, and a little apical suffusion of the same colour very pale: hind wing with the outer marginal line very faintly touched with the same tint of colour; otherwise the head, body, wings above and below, and the legs without any markings.

Expanse of wings, ♂, 1 inch.

*Hab.* Dinawa, 4000', Brit. N. Guinea.

**PYRAUSTINÆ.**

*Aphytoceeros subflavalis*, nov.

♂. Pale yellow; head and body without markings; abdomen with the anal tuft black; a small brush of yellow hairs in its middle. Wings above uniform pale yellow, markings pale chocolate-brown: fore wing with two outwardly oblique sinuous lines, two more antemedial, more close together; a dot in the cell, two short lines from the costa across the end of the cell, curved towards each other, with a darker line between

them; two more or less sinuous lines from the inner end of the above, straight to the hinder margin, slightly more separated hindwards; two postmedial lines from the costa to a little below vein 2, somewhat separated from each other at the costa, connected near its end by a thin sinuous line with the lower end of the discoidal lines, and four small rings attached to the outer half of these two lines: some marginal spots and a little suffusion below the middle of the space between: hind wing with a dark lunular line at the end of the cell; two lines from the middle of the costa extending inwards towards the anal angle, the lines anastomosing halfway down; a sinuous line from the costa near the apex to the anal angle, where it somewhat thickens: some suffusion at the apex of the wing; both wings with dark marginal line and yellow cilia, interlined by a pale brown line. Underside pale glistening yellowish white, the markings of the upperside more or less indicated. Body and legs yellow without any markings.

Expanse of wings, ♂,  $1\frac{1}{10}$  inch.

Hab. Antak Mts., 6000', N. New Guinea.

Not unlike a very large *Margaronia cesalis*, Walker.

# XXXI.—The Lemurs of the Hapalemur Group.

By R. I. POCCOCK, F.R.S.

## On Hapalemur and Prolemur.

IN addition to the skeleton and skull of the *Hapalemur simus* described by Beddard (P. Z. S. 1901, pp. 121-129), the Zoological Society's collection contains the following materials of *Hapalemur*, all the specimens being labelled *H. griseus*, Madagascar, without nearer locality:—

1. The skull of an adult but small specimen, without history of any kind.
2. The skin of a small, probably immature, male specimen which was received in Nov. 1857, and has never been described.
3. The skin of the adult male described by Beddard (P. Z. S. 1884, pp. 391-399), and later by Bland Sutton (P. Z. S. 1887, p. 369).
4. The skin and skull of an adult male dated June 9th, 1903, to Sept. 17th, 1904, which like no. 2, has never been described.



This paper is based primarily upon an examination of these examples.

The two species above named have quite an extensive literature. Skulls assigned to *H. griseus* have been figured on several occasions. To these and to the specimens in the Society's collection I shall revert later.

Good figures of the skull of *H. sinus* have been published, notably by Gray (P. Z. S. 1870, pp. 829-830, figs. 1-4), by Jentink (Notes Leyd. Mus. vii. 1885, p. 33), by Milne-Edwards and Grandidier (Hist. Nat. Madag. Mamm., Atlas ii. pls. cxxii. G & H, 1890-1896), and by Elliot (Mon. Primates, i. pl. xvii., 1912); and it may be noted that these figures attest no structural variations of moment, suggesting that more than one form has been described under the name *sinus*. As I shall presently attempt to show, this is not the case with skulls ascribed to *H. griseus*.

The generic name *Haplemur*, proposed in 1851 by I. Geoffroy for the species then known as *Lemur griseus*, met with universal and unchallenged acceptance until 1912, when Elliot, misled by a superficial inspection of the text, substituted *Miovicebus*—emended to *Myovicebus*—on the alleged, but entirely erroneous, grounds that Lesson in 1849 had given the latter title to the type-species of *Haplemur*. It is quite true that the first species cited under *Miovicebus* was named *griseus*; but it is equally and obviously true that the diagnoses, both generic and specific, of *Miovicebus griseus* have no applicability to *Haplemur griseus*. On the contrary, they fit tolerably closely the species for which they were intended, namely, *Chiropogon major*, then known as *milii*. It is possible that Lesson had at the time a specimen of a different but closely allied species of *Chiropogon* before him; but until evidence on that head is forthcoming *Miovicebus griseus* must stand as a synonym of *Chiropogon major*. *Haplemur* consequently resumes its former place in literature\*.

\* Another unnecessary change introduced by Elliot into the nomenclature of lemurs is the substitution of the new name *Attilenur* for *Opolemur* on the alleged grounds that Gray applied the latter generic term to *Chiropogon milii*. That is an incorrect interpretation of the facts. *Opolemur* (P. Z. S. 1870, pp. 853-854) was proposed by Gray for a species represented in the British Museum by specimens which he wrongly identified as *Chiropogon milii*. That his identification was erroneous is shown by the diagnosis and figures. The characters, stated and illustrated, of his *Opolemur* do not fit *Chiropogon*; hence the former cannot be a synonym of the latter, as Elliot asserted, and *Opolemur* must be restored to use, if the genus it designates is maintainable, with *Attilenur* as its synonym.

So far as I am aware, the only other name which can come generically into the little group of lemuroid species exemplified by *griseus* of L. Geoffroy is *Prolemur*, which was used by Gray first in a subgeneric, then in a generic, sense for the species he described as *sinus*. It appears to me that full generic rank should be assigned to this form. The characters upon which this opinion is based have been either figured or described by previous authors—notably by Gray, Beddard, M'He-Edwards, Grandidier, and Elliot,—who, however, did not attach so much importance as I do to the differences between *griseus* and *sinus* where they were appreciated\*. These differences appear to me to be of considerably greater systematic value than those which distinguish such genera as *Chirogaleus* and *Microcebus*, for instance.

To our knowledge of *Prolemur sinus* I have nothing to add. In the subjoined comparative diagnoses of *Hapalemur* and *Prolemur* I have merely made use of characters in *Prolemur* which have been stated by others or are apparent in their published figures.

*Hapalemur*, Geoffr.Type, *griseus*, L. Geoffr.

Gland on forearm present in both sexes.

Nasals long, extending back beyond lacrymal foramina.

Interorbital constriction not exceeding half the width of the postorbital constriction.

Mesopterygoid fossa much longer than its greatest width in front.

Width across paroccipital processes at most a little greater than length of nasals.

Malar orifice large, set back behind middle of orbit.

Symphysis of mandible strongly curved, chin rounded.

Ramus of mandible slightly everted behind dental line.

Upper  $pm^1$  much lower than canine, a little higher than  $pm^2$ ;  $pm^1$  and  $pm^2$  unlike in size and*Prolemur*, Gray.Type, *sinus*, Gray.

Gland on forearm present in neither sex.

Nasals short, not extending back to level of lacrymal foramina.

Interorbital constriction considerably more than half the width of the postorbital constriction.

Mesopterygoid fossa shorter than its greatest width in front.

Width across paroccipital processes much greater than length of nasals.

Malar orifice small, set forwards nearly in line with middle of orbit.

Symphysis of mandible not strongly curved, chin flattish.

Ramus of mandible strongly everted behind dental line.

Upper  $pm^1$  slightly lower than canine, much higher than  $pm^2$ ;  $pm^1$  and  $pm^2$  approximately alike

\* Gray's opinion, for example, that the species described by Schlegel as *Hapalemur griseus* was the same as his *H. sinus* attests failure in this respect on his part; and Beddard, when he suggested that Mivart had identified *sinus* as *griseus*, must have overlooked that author's description of the teeth.

*Hapalemur*, Geoffr.

form;  $pm^1$  molariform, with quadrate inner lobe;  $m^1$  and  $m^2$  with simple cingulum, without accessory cusp; no trace of groove on the inner cusp of these teeth behind.

Legs shorter; skull about six-sevenths the length of the femur\*.

*Plemur*, Gray.

in size and form;  $pm^2$  not molariform, with rounded inner lobe;  $m^1$  and  $m^2$  with bilobate cingulum, the posterior lobe cuspidate; the main inner cusp of these teeth grooved posteriorly.

Legs longer; skull about two-thirds the length of the femur.

*On the Species of Hapalemur.*

When *Hapalemur* was instituted two species were assigned to it by Geoffroy—namely, *griseus* and *olivaceus*. The latter was said to differ from the former in colour and in the shape of the lower jaw. Most subsequent authors have concurred in the specific identity of the two, and Milne-Edwards and Grandidier, who had access to Geoffroy's specimens, called *olivaceus* a variety of *griseus*; and their coloured figures show that *griseus* is lighter in tint than *olivaceus*. Elliot, however, admitted the two species because of the difference in colour and the larger size of the skull in *olivaceus*. The inference to be drawn from the literature, whether rightly or wrongly, is that the two forms may represent distinct subspecies, or possibly species, but that in any case they are closely related and exhibit few, if any, constant cranial differences except of size.

The three skins in the Zoological Society's collection are decidedly dark in tint, and may be described as dusky brown, the hairs being dark bluish grey annulated with rusty brown towards the tips. On the crown of the head the rusty brown is more in evidence, but round the eyes and on the cheeks it is less obvious. The underside is lighter than the upper. In the small specimen, received in 1887, the belly and thighs inside are bright buff, the throat grey. In the two others the throat is darker and the belly dark grey washed with brown. Provisionally I regard these skins as belonging to one and the same species and race, and the colouring enforces

\* Judging from M.-Edwards's figures of the skeletons of *H. griseus* and *P. sinus*. For instance, in *H. griseus* the skull measures 75 mm. and the femur 90; in *P. sinus* the skull is 81 mm. and the femur 120.

In the Zoological Society's specimen of *P. sinus* the femur is actually a little longer, being 122 mm. to the head, whereas the skull is shorter, namely, 75 mm. The skeleton, however, is that of an immature specimen, with the last molar teeth still buried in the bone, as Beddard's figure indicates. Probably the skull would have increased in length proportionately much more than the femur.

Unfortunately the leg-measurements of *H. schlegelii* are unknown. Hence the character above stated can only be used provisionally in a generic sense.

the conclusion that they are the *olivaceus*-form of *griseus*, and not typical *griseus*. This conclusion is borne out by the skull of the example received on 9. 6. 03, which is a little larger than the skull of *griseus* figured by Milne-Edwards and Grandidier. It also has the muzzle less steeply inclined, the posterior half of the zygomatic arch a little more arcuate, and the glenoid a little lower with reference to the dental line. I have not sufficient material to judge of the systematic value of these differences. Otherwise the two skulls are very much alike; and it is possible that M.-Edwards's illustration, as suggested below, was taken from an example of what he called the *olivaceus* variety of *griseus*.

I stated above that skulls of specimens assigned to *Hapalemur griseus* have been figured on several occasions; and the figures indicate confusion of more than one form under that name. For instance, if the figure of the skull published by Schlegel be compared with that published by Milne-Edwards and Grandidier, it will be seen that the differences between them fall quite outside the limit of individual variation exemplified by *Prolemur sinus* or by any single species of the Lemnidae known to me. Gray, indeed, declared that Schlegel had drawn the skull of an example of *Prolemur sinus* in mistake for *Hapalemur griseus*. With this opinion Bechard was disposed to agree, and Jentink tried to account for the error of this view by explaining that Schlegel's illustration was inaccurate, apparently because it did not agree with the skulls that he possessed. Doubtless it did not; but in my opinion Schlegel's figure was exact in all essential points, seeing that it agrees singularly closely with the adult skull in the Society's collection mentioned first on my list in the opening paragraph of this paper.

Similarly, the skull of the specimen that lived in the Gardens from June 1903 to Sept. 1904 agrees in the main, though not so closely as in the other case, with the skull of *H. griseus* figured by Milne-Edwards and Grandidier. Since these French authors had access to Geoffroy's type of *griseus*, it must be assumed that the example they identified as *griseus* belonged to that form or to *olivaceus*, which was regarded as the same, and that Schlegel's example was wrongly referred to *griseus*. Confirmation of this conclusion was supplied by Elliot, who also saw the specimens in the Paris Museum, and remarked in connection with Schlegel's illustration:—"This figure is badly drawn, or does not represent the skull of *H. griseus*. It is altogether too broad, especially the muzzle." From this passage it seems that Elliot was not prepared altogether to accept Jentink's verdict as to the inaccuracy of

Schlegel's figure, and that the possibility of another species being concerned dawned upon him. Nevertheless, the shortness of the muzzle misled him apparently in the matter of its apparent superior width.

Both the literature, therefore, and the skulls in my possession attest the existence of two well-marked species of *Hapalemur*—one exemplified by the small skull above referred to, which probably belongs to the form Schlegel identified as *H. griseus*, the other being the true *griseus* of Geoffroy, which has been well figured by Milne-Edwards and Grandidier. The former species I propose to describe as new, taking the skull in the Zoological Society's collection as the type. Since the only other skull I have at hand is that of the specimen determined, for reasons already stated, as *olivaceus*, I have diagnosed the new species with special reference to *olivaceus* rather than to *griseus*, although the differences between it and Milne-Edwards's figure of the skull of *griseus* are almost as well marked.

*Hapalemur schlegeli*, sp. n.

† *Hapalemur griseus*, Schlegel, in Pollen & Van Dam, Rech. Faune de Madag., Mamm. et Ois. p. 6, pl. vii. figs. 4 a-d (skull). Nec *H. griseus*, Is. Geoff.

Skull (type) considerably shorter but relatively broader, higher, and more arched antero-posteriorly along its upper profile, and less hollowed between the postorbital processes, than in *H. olivaceus*, the orbits relatively larger, with the inferior edge much more salient, giving a strongly sinuous curvature to the outline of the malar arch, and causing a deeper groove along the outer surface of its suborbital portion; the upper surface of the muzzle more depressed and curved, the upper portion of the maxilla compressed along the nasal suture, the lateral edge of the anterior nares emarginate in profile view, this orifice slightly higher than wide, compressed above. In *H. olivaceus* the muzzle and anterior nares are not compressed above and the latter orifice is slightly wider than high. The zygomatic arch and postorbital bar are relatively stouter than in *olivaceus*; the mastoid is inflated, reducing the paroccipital process, and the upper edge of the zygoma is not continued as a crest back to the occiput as it is in *H. olivaceus*, where the mastoid is not inflated but flat, leaving the paroccipital processes salient. The basiscranial axis is more steeply inclined, so that the bullæ and occipital condyles are set considerably lower with reference to the alveolar border of the maxilla than in *olivaceus*\*.

\* This difference is not so marked between the skulls of *H. schlegeli* and *H. griseus*, judging from M.-Edwards's figure of the latter.

Teeth of *H. schlegeli* shorter and narrower.

The typical skull of *H. schlegeli* has fully erupted and complete dentition and the sutures nearly obliterated. The obliteration, however, has not extended to quite the same extent as in the skull referred to *H. olivaceus*. Nor is there in the skull of *H. schlegeli* a median sagittal ridge on the parietal region. The low temporal crests are merely confluent near the middle of the parietals. The difference in this respect may be due to difference of age; but this is uncertain. When the two skulls are placed side by side on a flat surface they are practically the same height, despite the considerable disparity in length.

The differences in the shape and the dimensions of various parts of the skulls may be appreciated from the subjoined table of measurements of the type of *schlegeli* and of my skull referred to *olivaceus*. In the third column are given the dimensions taken from the figures of the skull named *griseus* by M. Edwards:—

	<i>schlegeli, olivaceus, griseus.</i>		
	mm.	mm.	mm.
Basal length .....	52	64	60
Length of palate along middle line .....	25	31	29
Length from post. edge of postorb. bar to tip of pnx. ....	36	42	37
Length from post. edge of orbit to lacrimal foramen .....	19	19	19
Height of orbit .....	14	14	14
Height from alveolar border to lower edge of orbit .....	9	12	10.5
Width of cranium .....	31	33	33
Width of postorbital constriction .....	23	19	19
Width of interorbital constriction .....	8	10	10
Width across zygomatic (postorbital) ..	44	49	48
Width across orbits .....	39	40	40
Width of muzzle above canines .....	14	17	16
Length of mandible from condyle .....	41	52	48
Width of upper pm <sup>3</sup> .....	45	55	5

Skulls assigned to *H. griseus* have also been figured by Jentink (Notes Leyden Mus. vii. pls. i. & ii. figs. 3-4, 1885) and by van der Hoeven (Tijds. Nat. Geschied. 1844, pl. i. fig. 1); but in both cases there are discrepancies in the dimensions of the superior and lateral views which make it impossible to tabulate the measurements. For instance, in the case of Jentink's specimen the superior view of the skull is 65 mm., the lateral view 62.5, whereas the lateral view of the mandible from the condyle is 44 and the superior view 40.

In Hooen's figure the superior view of the cranium is 59, the lateral view is 63. It may be noted that in M.-Edwards's figure of the skull of *griseus* the measurements coincide, as should be the case, both from the lateral and superior aspects.

Turning to Jentink's text, we find it stated that sixteen adult skulls measured 61 mm. in total length and 42 in width across the zygomata. They are thus considerably smaller than the skull of *griseus* figured by M.-Edwards, which is 73 mm. long and 48 broad, while my *olivaceus* is 76 mm. long and 49 broad. Clearly, therefore, Jentink's skulls were considerably smaller than the one depicted by Milne-Edwards and than the one I have described as *olivaceus*. This suggests the possibility of Milne-Edwards having described a skull of *olivaceus* as *griseus*, a course he might very well have adopted, seeing that he regarded *olivaceus* merely as a variety of *griseus*. Again, if the specimen figured by Jentink be a true sample of the sixteen he had for examination, they all differ from my *olivaceus* and Milne-Edwards's *griseus* in having a very much thinner postorbital bar. This, however, like the smaller size, may be a matter of age. Moreover, it will be noticed that the temporal crests are subparallel, showing scarcely any sign of convergence as far back even as the interparietal region, whereas in my *olivaceus* and M.-Edwards's *griseus* these ridges coalesce and form a fairly strong sagittal crest over the middle line of the parietal region.

But, whether Jentink's skulls represent a form distinct from M.-Edwards's *griseus*, or are merely less well-developed individuals of the same species, it is quite clear they are not referable to the same form as the one I have named *schlegeli*. They are too long and narrow, have very slender postorbital bars, and the frontal bones are depressed as in my skull of *olivaceus*.

There is no occasion to publish a figure of the type-skull of *H. schlegeli*, since it is in almost punctilious agreement with Schlegel's illustration, which shows the inflation of the mastoid, the sinuous curvature and suborbital salience of the malar arch, the thickness of the postorbital bar, the large orbits, the cranial width, the curvature of the upper profile, the shortness of the muzzle, etc. One rather marked difference in the tip of the muzzle may be explained, I suspect, by the cutting away of this part of the skull in Schlegel's example when it was removed from the skin. The incisor teeth are missing, as others have remarked, and this defect suggests that a portion of the premaxilla may have been cut away. If so, the ends of the nasals may have been truncated at the same time. This, however, is merely a suggestion. In the

type-specimen also the angle of the mandible is less rounded and the upper end of the coronoid is thinner, longer, and less curved than shown in Schlegel's figure.

The specimen described by Schlegel as *H. griseus* was discovered by Pollen at Ambassuana, three days' journey from the north-west coast of Madagascar. If, as I suspect, the type of *H. schlegeli* belongs to the same species, it probably came from the north-west coast of Madagascar, possibly also from Ambassuana.

#### *The Arm-glands of Hapalemur.*

The presence of glands on the forearm in *Hapalemur griseus*—or, rather, *olivaceus*, for such one of the specimens proves to be—was first pointed out by Beddard, who also ascertained, from Jentink and Milne-Edwards, that no such glands are developed in *Prolemur simus*. This character alone is sufficient, in my opinion, for generic separation of the two species.

In the two male specimens of *H. olivaceus*\* in which he described the glands, he pointed out that the naked tract of skin above the wrist was covered with long and coarse papillæ; but, judging from his figures, the papillæ were much better developed in the first specimen examined than in the second.

In the two other skins in the Society's collection, which Beddard did not see—namely, the small one received Nov. 10, 1887, and the adult received June 9th, 1903,—the gland differs in that the tract of integument is comparatively smooth, being merely roughened, so far as can be judged on the dried skin, with fine granular papillæ.

With regard to the glands on the upper arm, regarded by Beddard (but, I think, wrongly) as mammae, I can find no trace of them in the small and presumably immature skin; and in the adult skin with the glandular tract of the forearm nearly smooth they are less well developed than in the specimen in which they were first detected—namely, the one with the glandular area of the forearm exceedingly coarsely papillate.

I do not think any special importance should be attached to these differences, because in *Lemur catta*, which possesses similar glands, the spur on the glandular tract of the forearm, which may be compared to the papillæ in *Hapalemur*, varies

\* I have the dried skin of the example described by Beddard in 1884. Of the second specimen described in P. Z. S. 1891, p. 449, and 1902, p. 159, no history was given, and the skin was not preserved. Probably it was *olivaceus*.



in development with age, being larger in older specimens, and the gland of the upper arm is, I believe, subject to seasonal changes in size.

The occurrence of similar glands in two such widely different species as *Lemur catta* and *Haplorhina griseus*, and their complete absence in the other species referred to *Lemur* and in *Prolemur simus*, is a remarkable fact.

### XXXII.—*Some Notes on Three-toed Sloths.*

By OLDFIELD THOMAS.

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To those whose interest it is to compare zoological characters in their relation to geographical distribution no group of Mammals is so unattractive as the sloths, on account (1) of their variability, especially in the skull, in specimens from the same place, (2) the slight and intangible characters that distinguish specimens from the most distant localities, and (3) the great state of confusion that has resulted from the descriptive efforts of Wagler, Gray, and Fitzinger. Early descriptions, without statements of locality, have been made the basis of various names, and it is a matter of the greatest difficulty to disentangle the confusion.

The present notes make no pretence of being complete, and are purposely worded somewhat vaguely, as such are the difficulties of the case that there is hardly a statement I can make which may not prove liable to modification as fuller series from all localities are studied.

Firstly, with regard to genera, I am disposed to recognize the collared sloth, *Bradypus torquatus*, D. Smaest, 1817 (not Illiger, as usually quoted, for the latter author's two references are both *nomina nuda*), as forming a special genus, which may be distinguished by the inflated pterygoide, better developed premaxillæ, the median spout-like projection on the mandible, and the absence of a dorsal gland or "speculum" in the male\*, all these characters being as in *Choloepus*. The generic name of *Scoepus*, Peters, is available for it.

\* I can by no means subscribe to Dr. Allen's conclusion (Bull. Am. Mus. xx, p. 330, 1904) that "the presence or absence of this highly differentiated patch is not sexual"—a conclusion based on what I must consider the incorrect sexing of certain "females" by one of his collectors. Not only has it long been generally accepted that the speculum is characteristic of the male, but I find that in every specimen without speculum in our collection mammae are to be found, while in no example with speculum is there any trace of them. With so large a collection, including so many different forms, this evidence appears to me conclusive.

Synonyms of *Scœopus torquatus* are *crinitus*, Gray, 1849 (ex Browne), and *affinis*, Gray, 1849. The species is confined to South-western Brazil, but the limits of its range are not known. Mr. A. Robert sent a nice series of it to the British Museum from Engenheiro Reeve, Espirito Santo, in 1903.

Passing now to true *Bradypus*, we find the question of the identification of its type-species, *tridactylus*, Linn., a question so productive of confusion among the early writers, has now been settled by the fixation as the typical locality of the latter as Surinam\*—so that the Guianan species should bear the name *tridactylus*.

*B. tridactylus* is the best-marked of the species of the genus, being readily recognizable by the extension of the yellow colour of the face down the front of the neck—a character to which no approach is shown by any other species. Its skull is rather small and has generally a pair of peculiar taste or perforations in the floor (or, more strictly, the roof) of the anterior part of the mesopterygoid fossa; but, although so striking in well-marked cases that a person might excusably think it a character of generic value, this modification varies in different skulls, and is sometimes practically absent. The teeth are of average proportional size, the pseudo-canine † well differentiated, and the pseudo-incisor ‡ small, usually about a quarter the size in section of one of the molars.

Wagler (1831) was the first properly to distinguish this species, to which he gave its current name of *B. cuculliger*, while other synonyms of it are *Acheus ai*, Less.‡ (1827); *guianensis*, Blainv. (1839), a name doubtfully valid technically; *gularis*, Rüpp. (1845); and *cristatus*, Temm., Fitzinger, 1871.

*B. tridactylus* ranges over the whole of Guiana—French, Dutch, and British,—and our collection contains a good series of it, mostly presented by Mr. F. V. McConnell.

\* See Thomas, P. Z. S. 1911, p. 132.

† These names are used respectively for the second and first upper teeth, which, really corresponding to the anterior premolars of ordinary Mammals, take on in the three-toed sloths something of the relative proportions of a canine and an incisor. The three remaining teeth on each side, acting as a premolar-molar series, are subequal, smaller than the pseudo-canine, larger than the pseudo-incisor.

‡ This name was given to the "*Bradypus tridactylus*, L.," of Desmarest, which included all the forms of true *Bradypus* then known. It seems best placed as a synonym of *tridactylus*, especially as the animal is said by Desmarest to be very common in Cayenne. For the Brazilian *Aï de Maracay* it would be the earliest name, but there would be difficulty in justifying its use for that animal on technical grounds.

South of Guiana, from Para to Rio, and westwards up the Amazon, there occur a very uniform series of forms which may or may not be divisible into two or more species, but which it is impossible at present to clear up without many more sets of specimens. One locality only—Para—is well represented, as M. Robert got a series there in 1904.

Throughout this area the sloths are rather larger than *B. tridactylus*; the speculum is of normal size, as in that species, and of a rather less dark yellow colour, the general colour is brown mottled to a very variable extent with white, and the band of yellow velvety hair which passes across the forehead is usually about half an inch in breadth—say, 10-15 mm. The skull averages rather larger than that of *tridactylus*, and has generally a much inflated frontal region. The floor of the mesopterygoid fossa is usually flat, with or without median septum, and without special perforations. The teeth, although variable, are usually of what may be called normal proportions, the pseudo-incisor smaller—generally much smaller—than the molars, and the pseudo-canine decidedly larger than the latter.

The names for these sloths may be put in two groups—the Amazonian and the S.E. Brazilian—not that as yet I can see any valid reason for distinguishing the two specifically, but merely to help later workers.

(1) Amazonian: *B. infuscatus*, Wagl. 1831 (Brazil near Peruvian boundary); *brachydactylus*, Wagn. 1855 (syn. *speculiger*, Fitz. 1871) (Borba, Lower Madeira); *pubescentius*, Gray, 1849 (Para); *unicolor*, Fitz. 1871 (Para); *smithii*, Gray, 1869 (Para). *B. marmoratus*, Gray, 1849 ("Brazil"), seems also to belong here, judging by the type, and, if the Upper Amazon *infuscatus* proves distinguishable, would be the first name for the Lower Amazon form.

(2) S.E. Brazilian: *B. ai*, Wagl. 1831, nec Less. 1827 (R. Matheus, Espirito Santo); *brasiliensis*, Blainv.\* 1839 (Rio Janeiro); *pallidus*, Wagn. 1843 (Rio Janeiro); *blainvilliei*, Gray, 1849 (Brazil); *dorsalis*, Fitz. 1871 (Pernambuco—based on Maregrav).

Series from many localities are needed before these Brazilian sloths can be properly worked out, the available specimens—apart from M. Robert's set from Para already mentioned—consisting of isolated examples, often without any exact locality at all.

*Bradypus boliviensis*, Gray, 1871 (type B.M. no. 46.7.28.24), seems to be a valid species. Its speculum is of medium size,

\* Put in valid form on p. 64 of the article on *Bradypus*.

rather dark-coloured. The hairs of its throat are tipped with white, a point not seen in any other species, though probably not of great constancy. Its skull is large and solidly built, and the teeth are distinguished by the unusual character that the pseudo-incisor is very large—as large as or even larger than the pseudo-canine, which in turn is small, not exceeding the posterior molars in transverse section. These tooth-characters are, however, not to be seen in Gray's figure, which seems to have been taken from a wrong specimen. But that 46.7.28.24 is the proper type there can be no doubt, as its osteological number, 921, *a*, is quoted by Gray.

In Central America we have *B. castaneiceps*, Gray, 1871, of Nicaragua, and *B. griseus*, Gray, 1871, of Veragua, of which we have no further material, and I can add nothing to Aston's account of them except to note that Mr. Goldman considers them really distinct, and adds to them a third species—*B. ignavus*, from Panama and the Atrato River. It is, however, certain that *griseus* and *ignavus* at least are very closely allied to *B. flaccidus*. It is also to be observed that Dr. Allen has identified a sloth from Rio San Jorge, Boyacá, Colombia, with Philippi's *B. ephippiger*; and as an example from Coudoto, Choco, Colombia, presented by Dr. Sparrell, agrees with Philippi's figure in the great size of the speculum, the breadth of the frontal band, the distribution of the light and dark face-markings, and the size of the teeth, I am disposed to accept Dr. Allen's identification, and put down *ephippiger*, which was described without exact locality, as a native of N.W. Colombia, therefore in the same region as "*B. ignavus*" came from.

In any case, however, the relations to each other of *griseus*, *ignavus*, *ephippiger*, and *flaccidus* clearly need much further investigation.

*B. flaccidus*, Gray, 1849, has as type-locality Venezuela (probably the region opposite Trinidad), and has as synonyms *agouti*, Gray, 1869, and *columbicus*, Fitz., 1871.

But by what characters it can be positively distinguished from the Brazilian forms I have not sufficient good material to be certain.

From Ecuador the Museum contains, firstly, a set of five adults and two young from Sarayacu on the Upper Pastaza River, and, secondly, an adult from the Balzar Mts., Guayas district, W. Ecuador. These appear to me to represent two forms for which no names are available. The first may be called

*Bradypus macrodon*, sp. n.

Most nearly allied to *B. infuscatus*, but the teeth heavier.

General colour pale brown, the white marbling of the posterior back generally extensive, with a well-marked brown median line, but in one specimen there is scarcely any white, and in another but little. Face and chin brown, the light frontal band narrow, about half an inch (say, 10-15 mm.) in breadth, whitish rather than yellow in most of the specimens. Hairs on crown overhanging the frontal band rather darker than those on the body generally. Speculum of medium size, 2½ inches long in the type, paler yellow than in most other species, its median black band broad. Limbs freely marbled with white.

Skull much as in *B. infuscatus*, the forehead rather less convex than usual. Nasals, as usual, quite variable in shape and length, some convex and some concave anteriorly. Interparietal also extremely variable, its antero-posterior diameter in the type 15 mm., and in another specimen 7 mm. Mesopterygoid fossa widely open, its floor smooth and flat, or with a slightly raised median ridge, but without deep pits or excavations.

Teeth very large, much heavier than in *infuscatus*. Pseudo-incisor very large, oval in transverse section, the longest diameter pretty well equalling that of the molars, 4.3 mm. in the type, 5 mm. in another specimen. Pseudo-canine similarly very large and heavy, its greatest diameter about 6.2 mm., far exceeding the molars in bulk. Molars rarely less than about 5 mm. in greatest diameter.

Skull-dimensions of type:—

Naso-occipital length 78.5 mm.; condylo-basal length 78.3; greatest breadth (on squamosal) 56; nasals, length 12.5, least breadth 12.3; interorbital breadth 25.5; palate length from gnathion 29; postpalatal length 43; tooth-series 29; breadth between outer sides of pseudo-canines 22.6.

*Hab.* Sarayacu, Upper Pastaza River, Oriente of Ecuador.

*Type.* Adult male. B.M. no. 80.5.6.56\*. Collected by Clarence Buckley. Seven specimens examined.

This species is no doubt most nearly allied, as is natural, to *B. infuscatus*, but differs by the materially larger size of the teeth. Even in this character, however, one specimen fails (skull no. 80.5.6.59); but among sloths such variations must be expected.

\* The skulls were not individually allocated to the skins when they came, but I think there is little doubt as to the reference to each other of the type-skin and skull.

*Bradypus violeta*, sp. n.

Allied to *B. macrodon*, but distinguished from that, as from every other sloth, by the great extent of the yellowish velvety hair of the face, which extends upwards on the crown to the level of the ears nearly 60 mm. from its anterior commencement; the hairs of the cheeks as far as the ears also of the same colour and quality. Sides of throat likewise inclining to yellowish, in continuity with the cheeks, but the chin dark brown as usual, and the dark eye-streak also present. Nape, shoulders, and middle line at withers brown, the rest of the back nearly wholly white, as are also the hind limbs. Fore limbs brown, marbled proximally with white. Under surface dark brown anteriorly, whitish brown posteriorly. Speculum not known, the only specimen being a female.

Skull like that of *B. macrodon*, the forehead a little more swollen. Teeth of similar size and proportions.

Skull-measurements of type:—

Naso-occipital length 72 mm.; greatest breadth (on jugal) 49.5; nasals, length 14, least breadth 12.3; interorbital breadth 24; palate length from gnathion 28.5; tooth-series 27.2; breadth between outer corners of pseudo-canines 20; greatest diameter of pseudo-incisor 4, pseudo-canine 6, second molar 4.8.

*Hab.* Balzar Mountains, Guayas, W. Ecuador.

*Type.* Adult female. B.M. no. 80.5.6.83. Collected by Mr. Hingworth.

Characterized by its nearly wholly velvet-clothed face.

## PROCEEDINGS OF LEARNED SOCIETIES.

## GEOLOGICAL SOCIETY.

January 24th, 1917.—Dr. Alfred Harker, F.R.S., President, in the Chair.

Mr. SCORESBY ROUTLEDGE, M.A., gave an account of Easter Island. He said that the Expedition, that he had had the honour to command, was organized with the object of carrying out a long-standing wish of various bodies interested in anthropology. This wish was that Easter Island, and other islands most near to it, though far distant from it, should be thoroughly examined, and that all information and material thereon found should be carefully considered on the spot, or, if possible, be brought back for comparative study.

This programme necessitated a vessel being specially designed, built, and equipped for the purpose. A schooner with auxiliary motor power, the 'Mana,' of 90 tons gross register, 78 feet

on the water-line, 20 feet beam, and drawing 10·5 feet at, was accordingly completed by the end of 1912, and she sailed from Southampton in February 1913 with a company of twelve all told, of whom four formed the scientific staff. After the longest voyage ever made by a yacht under canvas, she sailed into Southampton again in June 1916, without having experienced accident to man or material.

The course taken was through the Magellan Straits, and thence through the labyrinth of Andean waterways that stretch north therefrom, and are known as the Patagonian Channels.

On reaching Juan Fernandez Island, the 'Muna' had to go back to Valparaiso because the geologist of the Expedition, the late Mr. F. L. Corry, had contracted typhoid fever on the Chilean coast. Mr. Corry never recovered sufficiently to allow him to rejoin the Expedition. Hence no formal geological report on the island could be submitted to the Meeting. It was thought best, therefore, to endeavour to convey the conditions existent on Easter Island by means of a series of panoramic and other photographs, specially taken to illustrate geological features. As these very largely consist of coast-sections, the opportunity was taken to show, and explain, other pictures that were closely associated with them. Such were the ruins of the village called Orongo, consisting of peculiar canoe-shaped houses built of imbricated slabs of slab, with the roof convex, both longitudinally and transversely, on its exterior aspect, and covered with earth. They are romantically situated on the rim of the volcano of Rano Kao, with an almost sheer drop of 900 feet into the sea, or of 600 feet into the crater-lake. At Orongo, too, are found certain large rocks, carved with the symbol of a bird-headed man, holding in its hand an egg. A cult, based on annually obtaining the first-laid egg of a certain migratory sea-bird, was thus gradually brought to light, and appears to be a unique form. A brief outline only could be given of some of the knowledge obtained concerning the peculiar notions associated with seeking, and taking, the sacred egg, and of the part which it occupied in the former religious life of the island.

Proceeding along the coast, typical examples of the great terraces, and their giant stone figures, were shown, and their leading characteristics discussed. A submarine freshwater spring, near the great image-terrace of Tongariki, and opposite certain typical lava-formed caves, gave occasion to the lecturer to explain how had arisen the long-standing, and world-wide spread report, that man and beast on Easter Island habitually drink sea-water, in the place of fresh.

The old volcano of Rano Raraku, the centre of the former religious life of the island, was then described. A series of panoramic pictures, preceded by an accurate survey made by Lieut. R. D. Ritchie, R.N., the Cartographer of the Expedition, showed a crater-lake surrounded by a rim of tuff which rises to a height of 540 feet above the surrounding plain. The plain is undulating in surface, formed superficially of hard, dense, but nevertheless vesicular, lava, and it rests on compact non-columnar

basalt. One section of this crater wall, some 600 yards long, on both its interior and exterior aspects, was seen to be quarried right up to the highest point. On the mountain-face, both inside and out, large numbers of statues, in every state of completion, were to be seen. The largest of these measured 68 feet in length. Some of those excavated by the Expedition exhibited fine details, such as the finger-nails, in perfect condition.

In conclusion, Easter Island might be described as a plateau of basalt raised from 50 to 100 feet above the sea. Superimposed on this were numerous cones ranging up to nearly 2000 feet. The plateau was covered but sparsely with soil, and could only be crossed with difficulty in any direct line. The cones, on the other hand, were generally smooth of surface, with a good depth of soil. Nevertheless the island is practically without trees, bushes, or shrubs.

February 7th, 1917.—Dr. Alfred Harker, F.R.S., President,  
in the Chair.

The following communications were read :—

1. 'The Trias of New Zealand.' By Charles Taylor Trechmann, M.Sc., F.G.S.

The fossiliferous Triassic rocks of New Zealand have been wholly or in part at different times attributed by the geologists of that Dominion to a Devonian, Permian, Permo-Carboniferous, Lower, Middle or Upper Triassic, or Trias-Jura age. A review of the previous research on these rocks and of their correlation and nomenclature is given. They are quite distinct from the Matai rocks, which contain a Permo-Carboniferous fauna.

Triassic beds appear at intervals from Kawhia on the western coast of the North Island to Nugget Point on the south-eastern coast of the South Island—a distance of 620 miles. Except in two localities, they are everywhere very steeply inclined, and where they approach the Alpine Chain of the South Island pass into semi-metamorphic greywackes or completely metamorphic phyllites and schists. They are of great thickness. A short description of the special faunal, lithic, and tectonic features of each of the more important localities is given, all of which but one occur in the South Island. In the North Island only the Noric and Rhaetic horizons have been recognized. Wherever the sequence is preserved, the Trias passes conformably up into Jurassic deposits.

The lowest fossiliferous horizon of the Trias occurs near the top of a great thickness of greywackes and conglomerates called the Kailiku Series, and is separated by several hundred feet from the next fossiliferous beds above it. The Kailiku fossils are scanty in species, and no cephalopods occur. Among those restricted to this horizon is *Daonella indica* Bittner, which occurs in Ludlow-Carnie deposits in the Himalayas and in the Malay Archipelago. Members or survivors of a Muschelkalk fauna occur in the form of *Spiriferinae* of the group of *Spiriferina fragilis* Schlotheim. It is concluded that the Kailiku fossil



horizon is either late Middle or early Upper Trias, and the unfossiliferous series below it represents the Middle and possibly Lower Trias.

The most highly fossiliferous division is the Carnic—the Otapi and Wairoa Series of New Zealand geologists. Several ammonites occur, among which *Discophyllites* cf. *cbneri* Mojsisovics is found in the Carnic and Lower Noric of the Himalayas. The *Halobia* include *H. zitteli* Lindström, a Spitzbergen fossil, together with *H. hochstetteri* Mojsisovics and *H. austriaci* Mojsisovics. Several of the Carnic fossils show affinities with European Alpine forms, and can be used for purposes of correlation.

The Noric horizon, the Otapiri Series in part, is represented by felspathic sandstones containing immense quantities of *Pseudomontis*, a genus which characterizes the Noric in all the Circum-Pacific Trias. *Ps. richmondiana* Zittel is known only from New Zealand and New Caledonia; but the Author found the Asiatic, Siberian, and Japanese form, *Ps. ochatica* Teller, in all its varieties, in very high Noric beds near Nelson.

The Rhaetic, the upper part of the Otapiri Series of local geologists, comprises a great thickness of sandy and pebbly beds. Its fossils include an extremely-alate *Spiriferina* and a group of specialized bisulcate *Spirigerids*. An *Arceetid* of Rhaetic aspect was collected high up in these beds at Kawhia.

Forty-seven genera and species of molluscs and brachiopods are recorded in the present paper, of which three genera and forty-one species are regarded as new.

The brachiopods are of considerable interest, and exhibit phylogenetic tendencies in several of the groups as they approach extinction.

The affinities of the New Zealand Trias with that of the Malay Archipelago, and especially of New Caledonia, is discussed; and it is shown that the faunal transgression which occurred over these regions, at or shortly before the commencement of Upper Triassic times, extended also to the area now occupied by New Zealand.

2. 'The Triassic Crinoids from New Zealand collected by Mr. C. T. Trechmann.' By Francis Arthur Bather, M.A., D.Sc., F.R.S., F.G.S.

The specimens are all from the Kaihiku Series, and comprise:—(1) an *Entrochus* from near Nelson, with a broadly waved suture; (2) a rock-fragment from the Hokamui hills, containing imprints of columnals and brachials representing two genera: namely, (*a*) an *Entrochus* with ridges of the joint-face arranged in pairs separated by shorter ridges; (*b*) an *Isocrinus* of the group of *I. dubius* (Goldfuss). Comparison of the three new species based on all these remains with the Triassic crinoids described from Europe and especially with those from North America, leads to the conclusion that they are of Upper Triassic age. They bear, however, no resemblance to the Upper Triassic crinoids from Timor, which the Author has in hand for description.





